ajer

THE ALBERTA JOURNAL OF EDUCATIONAL RESEARCH

VOLUME XXIX NUMBER 2 JUNE 1983

PUBLISHED BY
THE UNIVERSITY OF ALBERTA • EDMONTON

The University of Alberta
75th Anniversary
1982-83

THE ALBERTA JOURNAL OF EDUCATIONAL RESEARCH

A quarterly journal devoted to the dissemination, criticism, interpretation and encouragement of all forms of systematic enquiry into education and fields related to or associated with education.

Published quarterly in March, June, September, December by the
Faculty of Education, The University of Alberta

CONSULTING EDITORS

W. R. Andrews
Queen's University

D. C. Bjorkquist
University of Minnesota

P. E. Bryant
University of Oxford

B. M. Chung
Chungbuk University, Republic of Korea

A. Côté
University of Ottawa

D. Fitzgerald
The University of New England

D. B. Harrison
The University of Calgary

N. L. Hersom
University of Saskatchewan

E. Miklos
The University of Alberta

P. Robinson
Atlantic Institute of Education

R. E. Traub
Ontario Institute for Studies in Education

K. Watson
University of Reading

EDITOR: Doyal Nelson

SECRETARY: A. Onishenko

FACULTY PUBLICATIONS COMMITTEE

R. G. McIntosh (Chairman)
S. I. Jamieson (Operations Officer)
M. E. Compton (Secretary)
R. C. Bryce
A. K. Clark
A. M. Decore
L. D. Nelson
M. Rodda
M. J. van Manen

Editorial policy and the discussion and disposition of manuscripts are the joint responsibility of the Publications Committee. The views expressed and the accuracy of the statements made are the responsibility of the individual authors. The editor is solely responsible for the editorial comments.

AJER gratefully acknowledges support from the Social Sciences and Humanities Research Council of Canada and from the Alberta Advisory Committee for Educational Studies.

AJER is indexed in the *Canadian Education Index, Current Contents/Social and Behavioral Sciences,* and *Social Science Citation Index;* appropriate articles are abstracted in *Educational Administration Abstracts, Psychological Abstracts, Sociology of Education Abstracts, and Language Behavior Abstracts.*

The subscription rate is $12.00 per year; single copies are $3.50 each. Please make cheques payable to *The Alberta Journal of Educational Research.* All back issues are available; rates supplied on request. Claims for undelivered copies must be received within three months of publication.

Address all communications and manuscript submissions to the Editor, *The Alberta Journal of Educational Research,* Faculty of Education, 845 Education South, The University of Alberta, Edmonton, Canada, T6G 2G5.

SECOND CLASS MAIL REGISTRATION NUMBER 1436

ISSN 0002-4805

The Alberta Journal of Educational Research

Volume XXIX, Number 2 *June, 1983*

CONTENTS

The Influence of Teachers' Tolerances for Specific Kinds of Behaviors on Their Ratings of a Third Grade Student 89
B. Algozzine, J. Ysseldyke and S. Christenson

Comprehension Categorical Differences and Unit of Language Analysis 98
W. T Fagan and M. A. Currie

Occupational Situs, Family Learning Environment and Children's Academic Achievement 110
K. Marjoribanks

Principal Authenticity, School Climate, and Pupil-Control Orientation 123
W. K. Hoy and J. E. Henderson

Psychosocial Correlates of Dropout and Achievement in an Adult High School Completion Program 131
D. R. Garrison

Solving Textbook Mathematical Word Problems 140
J. M. Sherrill

BOOK REVIEWS

Instructional Design for Special Education, D. Baine 153
Reviewed by R. B. MacIntyre

The Schools of Ontario, 1876-1976, R. M. Stamp 155
Reviewed by R. J. Carney

FACULTY OF EDUCATION
The University of Alberta

The Alberta Journal of Educational Research *Volume XXIX, No. 2, June, 1983, 89-97*

BOB ALGOZZINE
University of Florida

JAMES YSSELDYKE

and

SANDRA CHRISTENSON
University of Minnesota

The Influence of Teachers' Tolerances for Specific Kinds of Behaviors on Their Ratings of a Third Grade Student

Behavior problems result from the complex interaction of child characteristics and adult beliefs and expectations. In this research, ratings of a third grade student were differentially effected by the tolerance of the rates for the primary behaviors exhibited by the pupil. Approximately 120 regular classroom teachers were asked to read a case study and respond to 13 questions about the student in it. Ratings of an immature *child were influenced by teacher tolerances while rating of an* unmanageable *student were not; the* unmanageable *student was rated more negatively overall. The concept of the 'ideal' student is presented in discussion of the results and their implications.*

School-related behavior problems have always been prevalent in America's schools (Sarason & Doris, 1979), and a variety of explanations have been set forth for the origins of these problems (Quay, 1973; Ysseldyke & Algozzine, 1982a). Academic and behavior problems may be viewed as the direct result of experiential action among these factors (Quay, 1973). From an ecological perspective, behavior is not problematic, deviant, or abnormal in and of itself; a

---

Bob Algozzine, PhD, is a Professor of Special Education at the University of Florida. His interests include psychoeducational assessment, and problem behavior management. He is a Research Associate with the Institute for Research on Learning Disabilities (IRLD) at the University of Minnesota.

James Ysseldyke, PhD, is Director of the IRLD and Professor of School Psychology at the University of Minnesota. His interests are in conducting policy research in school psychology and special education and in improving psychoeducational assessment practices.

Sandra Christenson is a doctoral fellow in school psychology at the University of Minnesota. Her interests center on factors influencing psychoeducational decision-making practices.

behavior is considered a problem as a function of the time it occurs, the place it occurs, the person who exhibits the behavior, and the person who sees it (a socially sanctioned labeler) (Ullman & Krasner, 1969). In school settings, the same behavior may be regarded as normal or abnormal as a function of the time and place in which it occurs; most importantly, problems are a function of the teacher or other school personnel who observe the behavior and their tolerance for it.

Rubin and Balow (1978) reported the results of a longitudinal investigation of 1,586 students, and indicated the following:

> [The] most striking finding of this study was the high percentage of children who were identified as exhibiting behavior problems by at least one teacher during the course of their elementary school careers. More than half (58.6 percent) of all subjects who received three or more teacher ratings were classified as a behavior problem at least once. Among students who received six teacher ratings, 60 percent (68 percent of the boys and 51 percent of the girls) were considered a behavior problem by at least one teacher. (p. 109)

Current rates of referral for psychoeducational evaluation are extremely high. Algozzine, Ysseldyke and Christenson (1982) report that nationally, four to six percent of the public school population is being referred for psychoeducational evaluation each year. Christenson, Algozzine, and Ysseldyke (1982) report that 92% of referred students are tested, while 73% of referred students are declared eligible for special education services. Clearly, problems in school are common for many of America's children.

Teachers' views of the causes for students' "problems" are interesting. In 1979, the research staff of the National Education Association (NEA) surveyed teachers to ascertain their perceptions of why students do poorly in school. They found that 81% of teachers placed the blame for school difficulties on students' home and family life, 14% blamed the students themselves; only 1% blamed inadequate instruction, while 4% attributed problems to the ways in which schools were organized. Clearly, the behaviors that students exhibit cause teachers to take a variety of actions with them, and the decisions made by teachers influence the lives and life opportunities of students.

Two recent investigations have reported an interaction between the kinds of behaviors that students evidence and teachers' tolerance for those behaviors in influencing the decisions made and actions taken with students. Curran and Algozzine (1980) found that decisions related to mainstreaming were influenced by teachers' opinions about demonstrated classroom behaviors. Ysseldyke and Algozzine (1981) found that the most influential piece of information in a simulation of psychoeducational decision making was student behavior at the time of referral.

In this investigation we examined the extent to which teacher decisions about a student were influenced by the student's characteristics in interaction with the teachers' stated tolerance for those characteristics. Ratings of case studies for an immature or unmanageable student were compared for teachers with differing levels of tolerance for those same behaviors.

Method

Subjects

Elementary school teachers ($n=116$) participated in the study; 92 percent of the teachers worked in public school classrooms. The sample was comprised

mostly of females (84%) from urban or suburban schools (70%) with school populations below 15,000 students (68%). Between 2 and 11 teachers were included from each grade represented (i.e., 1-7). The participants were well-educated; all had bachelor's degrees and many had master's degrees as well.

TABLE 1

DEMOGRAPHIC DATA FOR PARTICIPATING TEACHERS

Variable	Sample One	Sample Two
Teacher Sex		
Male	16	15
Female	84	85
Teacher Age		
Under 25	9	0
25 - 34	28	39
35 - 44	34	32
45 - 54	12	24
55 - 64	16	5
Years of Teaching Experience		
Less than 1 year	5	
1 - 2 years	5	
3 - 5 years	16	5
6 - 9 years	20	17
10 - 15 years	18	46
More than 16 years	36	32
Type of School		
Public	90	93
Private	10	7
School Location		
Urban	27	44
Suburban	44	24
Rural	29	32
School Population		
Below 3000	36	30
3000 - 6999	14	20
7000 - 9999	13	7
10000 - 14999	7	5
15000 - 24999	4	11
25000 - 49999	9	5
50000 - 74999	7	9
Over 75,000	10	13
Grade Level Taught		
First	18	17
Second	12	19
Third	18	17
Fourth	20	14
Fifth	9	17
Sixth	9	4
Seventh	14	12

Note. N = 57 and 59 teachers in Sample One and Two respectively; numbers reflect percentages of each sample.

Approximately half of the teachers (i.e., 57) were randomly assigned to read a case study describing a child with immature behavior; others (i.e., 59) received a description of an unmanageable student. The demographic data for both samples are presented in Table 1.

Procedures

The teachers were randomly selected from a national list of regular education teachers which was purchased from Market Data Retrieval. Each teacher was sent an initial letter explaining the study and offering payment for participation. Upon receipt of a signature indicating willingness to be included in the sample, each teacher was sent a case study and short questionnaire. A demographic survey form and *Disturbing Behavior Checklist II* (Algozzine, 1979) was sent subsequent to receipt of the initial materials; contracts arranging for payment were also included in the second set of materials. A two-week time limit was suggested for completion of each part of the study; however, follow-up letters and postcards were used to encourage the return of completed materials. The experiment, then, consisted of two stages: teachers first reacted to a child presented to them in a brief case study, they next provided their reactions to a set of behavioral descriptions. Tolerance for the behavioral descriptors was used to define groups of teachers whose ratings of the case study child were compared.

Case Studies. Two different summaries describing a third grade boy were prepared; a student demonstrating *socially immature* behaviors was described in one and a student exhibiting unmanageable behaviors was described in the other. The case studies were consistent in format. Each contained sections of similar information in these areas: medical, developmental, family, school history, test information, and third grade classroom observations. Assessment information was within the average range for a student of similar age and grade. Different behaviors were included to portray the *immature* or *unmanageable* student. For example, *limited expressive ability*, *very shy*, *insecure*, and *delayed age-appropriate social skills* were checked as concerns the case study of the *immature* child; other items of a similar nature were interspersed within the case study narrative. Different behaviors (e.g., *rude*, *defiant*, *lack motivation*) were "concerns" included in the narrative for the *unmanageable* student. It is important to note that except for the inclusion of these behavioral phrases, the case studies portrayed a rather ordinary child.

Dependent Questionnaire. After reviewing the case summary, teachers' ratings of the child were obtained by means of a short questionnaire. Specifically, teachers were asked to answer the following questions:

1. To what extent do you think David has a behavior problem?
2. To what extent do you think David has a learning problem?
3. To what extent do you think David is eligible for Special Education Services?

Responses were collected on a 1 (very unlikely) to 5 (very likely) scale. Teachers were also asked to make predictions about David's school performance (1 = deficient/poor, 5 = superior/excellent) in 10 areas: academic achievement, visual and/or auditory perception, memory skills, fine and/or gross motor performance, attending behaviors, completion of assignments, social acceptance, ability to follow directions, acceptance of responsibility and self-concept. Scores on these items were compared.

Independent Variable. After completing the initial activity, teachers were asked to supply demographic information and rate the extent to which certain behaviors bothered them. The *Disturbing Behavior Checklist II* (DBC-II) was the measure of teacher tolerance for different types of behavior. The DBC-II contains 51 items derived from case folders of students classified as learning disabled (LD) or from LD textbooks (Algozzine, 1979); each item is rated on a 1 (not very disturbing) to 5 (very disturbing) scale. Sutherland, Algozzine, Foster and Wall (1980) identified three factors within the DBC-II; behaviors which were bothersome to teachers were contained in each. The first factor of disturbing items (i.e., general perceptual problems) included problems such as written reversals, poor word attack skills and being unable to blend sounds. Unmanageable behaviors (i.e., Factor 2), such as rudeness, impulsivity, irritability and hyperactivity, and immature behaviors (i.e., Factor 3), such as insecurity, anxiety, and inadequate self-concept were also found to be disturbing to teachers. In this research, average scores on the immature and unmanageable behavior factors of the DBC-II were used to group teachers into those with more or less tolerance for the specific behaviors in the factors.

Teachers receiving the case summary for an immature or unmanageable student were subdivided into two additional groups each. Those with ratings greater than the sample mean on Factor 3 (i.e., immaturity) on the DBC who received the case study describing an immature student were compared to teachers whose ratings were below the mean on that factor. Similarly, the teachers who received the unmanageable student's case study summary were divided according to their responses to the items comprising Factor 2 (i.e., unmanageable behaviors) of the DBC-II. In this way, the effects of teacher tolerances for behaviors on their ratings of a student exhibiting those same behaviors were evaluated.

Data Analysis

Two sets of *t*-tests were completed. High and low tolerance groups were compared on 13 different responses about a student exhibiting immature or unmanageable behaviors. Because of the large number of tests, two stringent criteria were set for significance testing; the 0.01 *alpha* level was used for statistical tests and a 0.5 unit difference between means was applied in an attempt to separate trivial findings from important ones.

Results

Teachers were requested to rate the extent to which the case study student had a behavior problem, a learning problem, and was eligible for special education services; similarly, predictions in 10 areas of school-related functioning were solicited. Comparisons of ratings made by teachers more tolerant of immature behavior and those less tolerant of the same behavior were completed. No differences were indicated in the teachers' ratings of the immature student's current problems (i.e., academic or behavior) or eligibility for special education (see Table 2); however, it should be noted that less tolerant teachers ratings were less favorable in each case than those of tolerant teachers. Significant differences were indicated in teachers' predictions of the future classroom and interpersonal behaviors of the immature student. Tolerant teachers ($n=27$) rated 9 of the 10 prediction areas higher than the intolerant teachers ($n=29$). Predictions for

academic achievement, memory skills, and motor performance were higher for tolerant teachers; similarly, attending behaviors, completion of assignments, and ability to follow directions were more highly rated by teachers who were more tolerant of immature behavior. Interpersonal skills such as social acceptance, self-concept, and acceptance of responsibility were also rated differently by tolerant and intolerant teachers. Means and standard deviations for teachers' predictions for a student exhibiting immature behavior are presented in Table 3.

TABLE 2

MEANS AND STANDARD DEVIATIONS FOR TEACHERS' JUDGMENTS OF IMMATURE STUDENT'S CURRENT BEHAVIOR

Judgment	Group			
	Tolerant		Intolerant	
	$\bar{X}$	SD	$\bar{X}$	SD
To what extent do you think David has a behavior problem?	2.9	(1.4)	3.2	(1.5)
To what extent do you think David has a learning problem?	3.4	(1.1)	3.8	(1.0)
To what extent do you think David is eligible for special education services?	3.0	(1.3)	3.5	(1.2)

Note: 1 = Very Unlikely 5 = Very Likely

TABLE 3

MEANS AND STANDARD DEVIATIONS FOR TEACHERS' PREDICTIONS FOR STUDENT EXHIBITING IMMATURE BEHAVIOR

Prediction Area	Group			
	Tolerant		Not Tolerant	
	$\bar{X}$	SD	$\bar{X}$	SD
Academic Achievement	2.8	(0.7)	2.2	(0.8)*
Visual and/or Auditory Perception	3.0	(0.6)	2.6	(0.9)*
Memory Skills	2.9	(0.8)	2.3	(0.7)*
Fine and/or Gross Motor Performance	2.9	(0.8)	2.4	(0.8)*
Attending Behaviors	3.0	(0.8)	2.3	(1.0)*
Completion of Assignments	3.1	(1.0)	2.3	(1.1)*
Social Acceptance	2.9	(0.9)	2.2	(0.9)*
Ability to Follow Directions	3.1	(0.9)	2.5	(1.0)*
Acceptance of Responsibility	3.1	(0.9)	2.5	(1.0)*
Self-Concept	3.2	(1.2)	2.5	(1.3)*

Note: 1 = deficient or poor 5 = superior or excellent. * $p < .01$

No differences were indicated for ratings of the unmanageable student (see Table 4). Teachers with different levels of tolerance rated a student exhibiting unmanageable behavior similarly. It should be noted, however, that the judgments about this student were more negative than those made about the immature child. For example, special education eligibility was more likely ($\bar{x}$ = 3.85) for the unmanageable student than the student exhibiting immature behaviors ($\bar{x}$ = 3.25), a similar pattern was evident in other ratings as well. This suggests that the unmanageable student is more likely to be viewed as a problem regardless of one's tolerance for behavior which is exhibited and that different reactions may result in teachers faced with an "immature" student.

TABLE 4

MEANS AND STANDARD DEVIATIONS FOR TEACHERS' RATINGS OF THE UNMANAGEABLE STUDENT

Teacher Ratings	Group			
	Tolerant		Not Tolerant	
	$\bar{X}$	SD	$\bar{X}$	SD
Judgment				
Behavior Problem	4.7	(0.5)	4.6	(0.9)
Learning Problem	3.4	(1.1)	3.8	(1.1)
Special Education Services	3.8	(1.2)	.3.9	(1.1)
Prediction				
Academic Achievement	2.0	(0.8)	2.2	(0.9)
Visual and/or Auditory Perception	3.1	(0.8)	3.0	(0.8)
Memory Skills	2.7	(0.9)	2.7	(1.0)
Fine and/or Gross Motor Performance	3.0	(0.7)	3.0	(0.9)
Attending Behaviors	2.1	(1.0)	1.9	(0.9)
Completion of Assignments	2.3	(1.1)	2.2	(1.2)
Social Acceptance	2.3	(1.1)	2.0	(1.1)
Ability to Follow Directions	2.4	(0.9)	2.1	(0.9)
Acceptance of Responsibility	2.4	(0.9)	2.0	(1.1)
Self-Concept	2.6	(1.2)	2.2	(1.3)

Note: 1 = deficient or poor 5 = superior or excellent

Discussion

Mixed results were obtained in this investigation of the extent to which teachers' tolerances for different kinds of behaviors influenced their perceptions of students who evidenced those behaviors. Consistently, teachers' tolerances for specific kinds of behaviors did not significantly influence the extent to which they saw students who exhibited those behaviors as having learning problems or behavior problems, or as being eligible for special education. However, teachers did have different prognoses for students who exhibited immature behaviors, and their prognoses were a direct function of their tolerance for those behaviors. Teachers who were not bothered by immature behavior held higher expectations for a student who evidenced immature behavior; however, no differences were indicated in ratings of the unmanageable student by teachers with different

tolerance for exhibited behaviors. Overall, a student with unmanageable behaviors was viewed less favorably than one with immature behaviors.

In discussing the relation between "teachers' perceptions and educational decisions," Kornblau and Keogh (1980) indicated that:

> The complexities of teacher-pupil interaction have long interested educational researchers, yet it seems fair to say that the nature of the functional "match" between pupil and teacher remains uncertain. Fortunately, in most classrooms both child and teacher can tolerate considerable discrepancy from an ideal match. In the case of exceptional children, however, the match may be especially important, since they may be less able to tolerate incompatibilities with teachers' expectations and styles. It is interesting to note that the historical and still common response to pupils who "don't fit" in the regular educational program is to exclude them. Current legislation, however, has mandated the inclusion of exceptional children into regular programs wherever feasible. Consideration of teacher-pupil interaction thus becomes practical and urgent. (p. 87)

It is interesting to note their concern for the child's limited tolerance in appropriate educational "matches."

In 1970, Rist suggested that teachers' views of "ideal" students influence perceptions and evaluations of actual students. Recently, Kornblau (1979) identified three dimensions of behaviors which characterized "ideal, teachable" students; she labeled them: cognitive-motivational behaviors, school appropriate behaviors, and personal social behaviors. Behaviors which characterize "ideal" students are *not* included on the disturbing behavior checklists.

Student behaviors are a function of a complex set of interactions; to a large degree, problems are thought to originate in the life experiences of the *child* (*cf.* National Education Association, 1979; Quay, 1973). Kornblau and Keogh (1980) indicate that "understanding pupils' progress in school also involves consideration of the teachers' perceptions and expectations" (pp. 98-99). They also suggest that teachers' expectations for individual students are "in part influenced by their values of the characteristics of a model ideal pupil, and that discrepancies from this model affect the formation of self-generated expectations" (p. 99).

In this research, less than "ideal" characteristics were manipulated in case studies and evaluated by regular education teachers; in part, evaluations were influenced by tolerance for the characteristics. The results have implications for diagnostic and prescriptive practice. Simply evaluating the psychoeducational characteristics of the *child* appears to be a limited diagnostic practice; clearly, the child's teacher is an important factor in any referral for evaluation. Similarly, since the child is only part of an educational dyad, planning instructional intervention without concern for teacher tolerances and/or expectations for differing types of students may result in limited educational outcomes. As Kornblau and Keogh (1980) indicate, "[i]t is not realistic to expect teachers to work equally effectively with all pupils; but it is realistic to expect teachers to be sensitive to their own perceptions of their pupils" (p. 99). In this work, we found that a group of teachers with different degrees of sensitivity (we called it tolerance) reacted differently to a student exhibiting behaviors to which sensitivity varied. The extent to which similar outcomes would be present in a naturalistic classroom environment was not addressed; however, the results obtained in this work are initial evidence that such additional research would provide fruitful data for diagnostic-prescriptive planning.

The preparation of this manuscript was supported in part by Contract #300-77-0491 between the U.S. Bureau of Education for the Handicapped and the University of Minnesota Institute for Research on Learning Disabilities; Bob Algozzine is associated with the Institute. The authors wish to acknowledge the professional assistance of Leila R. Cantara and Vicki Vaughan in preparing this manuscript.

References

Algozzine, B. *The disturbing child: A validation study.* Minneapolis: Institute for Research on Learning Disabilities, 1979 (Research Report #8).

Algozzine, B., Ysseldyke, J., & Christenson, S. An analysis of the rate of referral for and placement in special education classes. Manuscript submitted for publication, 1982.

Christenson, S., Algozzine, B., & Ysseldyke, J. E. Probabilities associated with the referral to placement process. *Teacher Education and Special Education*, 1982, *5*(3), 19-23.

Curran, T. J., & Algozzine, B. Ecological disturbance: A test of the matching hypothesis. *Behavioral Disorders*, 1980, *5*, 169-174.

Kornblau, B. W., & Keogh, B. K. Teachers' perceptions and educational decisions. *New Directions for Exceptional Children*, 1980, *1*, 87-101.

National Education Association. Teacher opinion poll. *Today's Education*, 1979, *68*, 10.

Quay, H. C. Special education: Assumptions, techniques, and evaluative criteria. *Exceptional Children*, 1973, *40*, 165-170.

Rist, R. Student social class and teacher expectations: The self-fulfilling prophecy in ghetto education. *Harvard Educational Review*, 1970, *40*, 414-451.

Rubin, R. A., & Balow, B. Prevalence of teacher identified behavior problems: A longitudinal study. *Exceptional Children*, 1978, *44*, 102-111.

Sarason, S. B., & Doris, J. *Educational handicap, public policy and social history.* New York: Free Press, 1979.

Sutherland, J., Algozzine, B., Foster, G., & Wall, C. The LD child: An ecological problem? *Diagnostique*, 1979, *4*, 52-59.

Ullman, L., & Krasner, L. A socio-psychological approach to abnormal behavior. Englewood Cliffs, NJ: Prentice-Hall, 1969.

Ysseldyke, J. E., & Algozzine, B. *Critical issues in special and remedial education.* Boston: Houghton-Mifflin, 1982. (a)

Ysseldyke, J. E., & Algozzine, B. Diagnostic classification decisions as a function of referral information. *Journal of Special Education*, 1981, *15*(4), 429-435.

The Alberta Journal of Educational Research *Volume XXIX, No. 2, June, 1983, 98-109*

WILLIAM T. FAGAN

and

MARGARET A. CURRIE

The University of Alberta

Comprehension Categorical Differences and Unit of Language Analysis

Content analysis is an important methodological procedure in educational research. Its use necessitates two important decisions: the unit of analysis and the category system for coding the data. A number of studies have been completed using a system of comprehension categories for recall analysis. However, the unit of analysis has varied among studies. This study investigated the influence of using each of three units of analysis (t-unit/incomplete t-unit, clause, and syntactic proposition) on the assignment of data to the comprehension categories. There were significant correlations between corresponding categories for the t-unit/incomplete t-unit and clause which suggests that the use of either of those units gives similar results. The use of the syntactic proposition will result in a different profile in terms of the amount of information assigned to the comprehension recall categories.

Content analysis is a recognized methodological procedure in educational research. Content analysis allows the researcher to describe the content of various situations, particularly language situations. In order to apply this methodological procedure, two key decisions which must be made concern the *unit of analysis* and the *system of categories* to which these units are to be assigned. It is possible that a different category profile may result depending on the unit chosen for the initial analysis of the data.

Dr. Fagan is a Professor of Education in the Department of Elementary Education at The University of Alberta. One of his main interests is the delineation of cognitive and linguistic processes in which readers of various ages and achievement levels engage. Dr. Fagan was the recipient of the Outstanding Dissertation of the Year Award (International Reading Association) and of the Alberta Provincial Government Achievement Award.

Ms. Currie is coordinator of the English as a Second Language Program at Bonnie Doon High School, Edmonton.

Discourse Analysis

Although as early as 1932, Bartlett focussed on analysis at the discourse level in experiments on remembering, it was not until the 1970's, in what appeared to be a backlash against transformational grammar and its focus on the sentence as the unit of meaning, that discourse analysis received its great impetus.

Analysis of Recall Data

In the Bartlett tradition, many researchers concerned themselves with analysing the recalls of subjects in response to a particular text. Even though they varied somewhat in their views about the relationships of recalls to text input, in order to conduct an analysis of the recalls it was necessary to devise a structural description of the text. The resulting descriptions often differed in the emphasis placed on various structural elements. Grimes (1972), for example, believed that connected discourse should be studied at three levels — content, cohesion, and staging of the information in the text. The content was mainly comprised of semantic information such as role relations (e.g., agent), while cohesion focussed on the structural relations of text elements via a referential system (e.g., pronominalization). The final component, staging, referred to the positioning of information which allowed the speaker to select certain pieces of information for greater focus. Frederiksen's (1975) model of discourse structure was more complex than Grimes' but there were similarities. For example, the semantic structure included a dependency system (consisting of a logical and a causal system) and was similar to Grimes' cohesion component. A system devised by Drum (1974) focussed exclusively on inter-sentence dependence, and she specified a number of logical and referential connectives by which sentences are related.

Researchers such as Meyer and McConkie (1973), Meyer (1975,1977), Kintsch (1972,1974) and van Dijk and Kintsch (1976) concerned themselves with the "importance" of elements within the text structure and the hierarchical relationships of these elements, while another group of researchers focussed on one particular form of text — the narrative (Rumelhart, 1976; Mandler & Johnson, 1977; Thorndyke, 1977; Stein & Glenn, 1978). Their structural descriptions of stories were designed to predict which story components (setting, goal, etc.) would be best remembered.

Drum and Lantaff (1977) devised a system of categories for protocol analysis which was designed to assess the kinds of information that subjects retained after reading a text. These categories were further refined by Fagan (in press) and were subsequently used in a number of research studies (Zinn, 1979; Beebe, 1981; Brake, 1981; Clarke, 1981; Machura, 1981).

Unit of Analysis

Regardless of the structural description, a particular unit of analysis must be chosen in order to determine the similarities between the recall protocol and the text. In many cases the protocols were analysed for the presence of elements specified within the text structure (e.g., goal in story grammar, referential connectives in relational information systems). The semantic proposition was defined as a unit comprising at least two concepts — one expressing a relation and one or more designating an argument. A very detailed system of utilizing the proposition was developed by Turner and Greene (1977) for constructing a text

base which supposedly was an idealized account of the semantic information conveyed by means of a particular discourse. The syntactic proposition originated with Fagan (1978) and was similar to the semantic proposition except that it was identified on the basis of semantic *and syntactic* criteria.

Other units used in text analysis originated for the purpose of describing oral or written language (independent of recall). Most common among these units are the communication unit (Loban, 1976), the t-unit (Hunt, 1965), the incomplete t-unit (Fagan, 1978), and grammatical elements from traditional or structural grammar, such as the clause (Strickland, 1962).

The t-unit, incomplete t-unit, syntactic proposition, and clause have all been used in the studies that have used Fagan's system of recall categories. The question that needed to be answered was, "Does the profile obtained by using the comprehension category system differ according to the unit of analysis used?"

The t-unit/Incomplete t-unit.

The t-unit was initially devised by Hunt (1965) and was similar to Loban's (1976) communication unit. Whereas the communication unit need not be structurally intact (e.g., the response "yes" to the question, "Will you be at the hockey game?"), the t-unit had to have all syntactic elements specified. It was defined as containing a main clause and any subordinate clauses attached. Fagan (1978) questioned the logic and feasibility of eliminating language data which did not fit into t-units since speakers often utter sequences of words that are not grammatically intact in the sense of having a finite subject and a finite verb. Consequently, Fagan (1978) devised the "incomplete t-unit" to account for the language data that would not fit the t-unit description. An incomplete t-unit was considered equivalent to a t-unit in terms of the semantic value it could carry; its key difference was that it was not syntactically intact as a main clause (and a subordinate clause) but lacked either the specified subject, a verb, or necessary complement. The conversation example below has been divided into t-units and incomplete t-units (latter in italics).

Jim: Don't forget that we meet at Mrs. Smith's house at eight tonight. *Auditions for the school play.*

Bob: Is that the big stucco house on Elm Street?

Jim: *No, across from Pine Park on Second.*

Bob: Can you give me a ride?

Jim: *7:45 at your place.*

The first, "Auditions for the school play," lacks a finite verb. To make it a complete clause (syntactically) it would have to read "Auditions for the school play will be held" or "She will be holding auditions for the school play," etc. However, in its present form it cannot be ignored semantically for it still carries approximately the same semantic meaning as if it had been stated in complete syntactic form.

The Clause

A clause is defined as a unit of language that contains a finite subject and a finite verb. A clause may be either main or subordinate. There are two clauses in the t-unit, "*(You) don't forget*/that *we meet* at Mrs. Smith's house at eight tonight." (Subjects and verbs are in italics).

The Syntactic Proposition

It was Fagan's (1978) contention that since all semantic ideas are expressed in syntactic form it should be possible to start with the syntactic forms and infer the semantic content. Accordingly he identified 20-22 such syntactic units. The units were of two types, base and alternate. A base unit was the simplest syntactic form in which a semantic idea could be expressed. Examples were "The dog barks," "The child is swimming." An alternate unit was attached to a base unit and with the addition or substitution of words could be written as a base unit. For example, the alternate syntactic unit (in italics) in the sentence, "Is that the big[1] stucco house *on Elm Street"* can be rewritten as "The big stucco house is on Elm Street."

Comprehension Categories

Five major categories have been identified and are defined below. Specific criteria for allocating recall data to each of these categories may be found in Fagan, in press; Clarke, 1981; and Kavanagh, 1981.

Category A: Text Exact. This category includes information from the text in its exact form or with minimal variations.

Category B: Text Specific. This category includes information recalled that had specific references in the text. The reader may have "transformed" some of this information by reordering or substituting lexical items.

Category C: Text Entailed. This category includes information which is retrieved as (a) a paraphrase of or synonymous with the information input, but the unit of recall includes information from more than one unit of input, or (b) a subordinate statement subsuming information from more than one text unit.

Category D: Text Experiential. This category includes information added by the reader to fill in gaps in the text data.

Category E: Text Erroneous. This category includes information which the reader has processed incorrectly, either at the time of comprehending or at production of the recall.

Related Research Studies

Clarke (1981) and Brake (1981) were interested in recall differences between high and low reading achievers. Clarke investigated the oral reading of a sample at the grade four level while Brake worked with grade two subjects and examined their performance in oral and silent reading. Neither researcher found differences between reading groups. Brake, however, found that the subjects recalled more text specific information when reading orally and more text erroneous information when they read silently. Whereas Clarke used the *clause* as the unit of analysis, the amount of information in Brake's categories was based on the *t-unit/incomplete t-units.*

Beebe (1981), like Clarke, worked with grade four subjects, and divided their recalls on the basis of the *clause* unit. She found that the best predictor of comprehension was the use of integrated and synthesized information. As would be expected, the use of erroneous information was a significant indicator of low reading comprehension.

Zinn (1979), and Machura (1981) were interested in the relationship of the subjects' recalls and the number/nature of connectives involved. Both used high

and low reading achievers at the grade four level in their sample, but whereas Zinn used the t-unit/incomplete t-unit as her unit of analysis, Machura divided her protocols on the basis of the *clause*. Zinn found that when subjects read a passage with the logical connective "because" present, the low reading group produced more recall data that was classified as text external (drawn from the readers' experiences). When passages without this causal connective were read, more specific text information was recalled by the low reading group and more integrated information by the high reading group. Machura (1981), who concentrated on passages with greater and fewer numbers of perceptual connectives of time and space, found that whereas high and low reading achievers did not differ in the nature of the information recalled (as assigned to comprehension categories), readers did produce more perceptual connectives in their recalls if they were present in the input passages.

Design

Sixteen recall protocols were analysed according to three different language units and were then assigned to one of five comprehension categories. Pearson Product Moment correlations were computed to determine the agreement of assignment to categories across units.

Sample[2]

Sixteen grade six students, who were reading at least at a grade five level according to a standardized reading test, were chosen. The subjects were Cree or Metis, that is they had been brought up in homes where Cree was spoken, and their parents, at least, actively conversed in this language. The official definition of Metis was also used as a guideline, that is, they should have at least a quarter Native blood. Of 20 students who met this criterion, 16 were chosen from 17 volunteers.

Passage

The story used is a popular European fairytale "The Elves and the Shoemaker" from *Grimm's Tales*. The story was rewritten so that it corresponded to the Mandler and Johnson (1977) grammar for a canonical story. The story contained 54 t-units/incomplete t-units, 81 clauses, and 157 syntactic propositions.

Procedures

Testing was done individually and the subjects were given the following directions:

I am interested in how children remember stories. I want you to read this story. Make sure that you have understood it well. Later you will be asked to tell it again as exactly as you can.

Following a five minute break in which the subject was engaged in giving the researcher some background information, discussing home and school activities, and examining some objects brought by the researcher, the student was asked to recall the story. The instructions were as follows:

> Now would you tell me the story that you read. Try to remember as much of it as possible.

When it appeared that subjects were finished with the recall, they were asked if there was anything else. The recalls were recorded and later transcribed for analysis.

Analysis

The sixteen protocols were analysed separately into each of the language units and then assigned to the comprehension categories. The first analysis was in t-units/incomplete units; the second analysis was in terms of clauses and the third in terms of syntactic units. The interrater reliability (using two independent raters) for each of the analysis is given in Table 1.

TABLE 1

INTERRATER RELIABILITY FOR UNITS OF ANALYSIS AND ASSIGNMENT TO CATEGORIES

	Percent Agreement
T-unit/incomplete t-unit	98.7
Clause	99.8
Syntactic Proposition	90.3
Comprehension Categories	97.6

Findings

Means and Standard Deviations

The means and standard deviations for each category on the basis of each unit of analysis are given in Table 2.

TABLE 2

MEANS AND STANDARD DEVIATIONS FOR PERCENT OF RECALL ASSIGNED TO COMPREHENSION CATEGORIES ON THE BASIS OF THREE UNITS OF ANALYSIS

Category		T-unit/ Incomplete t-unit	Clause	Syntactic Proposition
A	$\bar{X}$	2.59	2.78	4.35
	SD	2.40	2.83	3.70
B	$\bar{X}$	53.44	58.39	41.34
	SD	7.73	6.17	6.04
C	$\bar{X}$	18.42	13.82	32.20
	SD	7.31	6.38	9.63
D	$\bar{X}$	23.07	23.24	19.62
	SD	9.60	9.54	6.85
E	$\bar{X}$	2.49	2.75	3.06
	SD	2.88	2.41	2.62

The data on this table show that most of the information recalled fell into the Text Specific category while the least amount was either Text Exact or Erroneous. The means of these two categories was usually very close.

An analysis of the types of text information recalled relative to one another is more similar for the data assigned on the basis of the t-unit/incomplete t-unit and the clause. The profiles of the data recalled by category are graphed in Figure 2. This graph shows that whereas most recall information was assigned to Category B on the basis of all three units, the height of the graphs for this category was closer for the first two units. The means for Categories A and E also follow the same relative order but the means for these two categories are higher when information is assigned to categories on the basis of the syntactic proposition than when assigned on the basis of the other two units. The most noticeable change occurs when information is assigned to Category C and D. The relative weight of these means are in the opposite direction for the syntactic proposition when compared to the other two units. However, the mean for the D Category is relatively similar across units. Standard deviations are relatively consistent across units which would seem to indicate that the dispersion among subjects in terms of the data recalled is similar regardless of the unit chosen for assignment to categories.

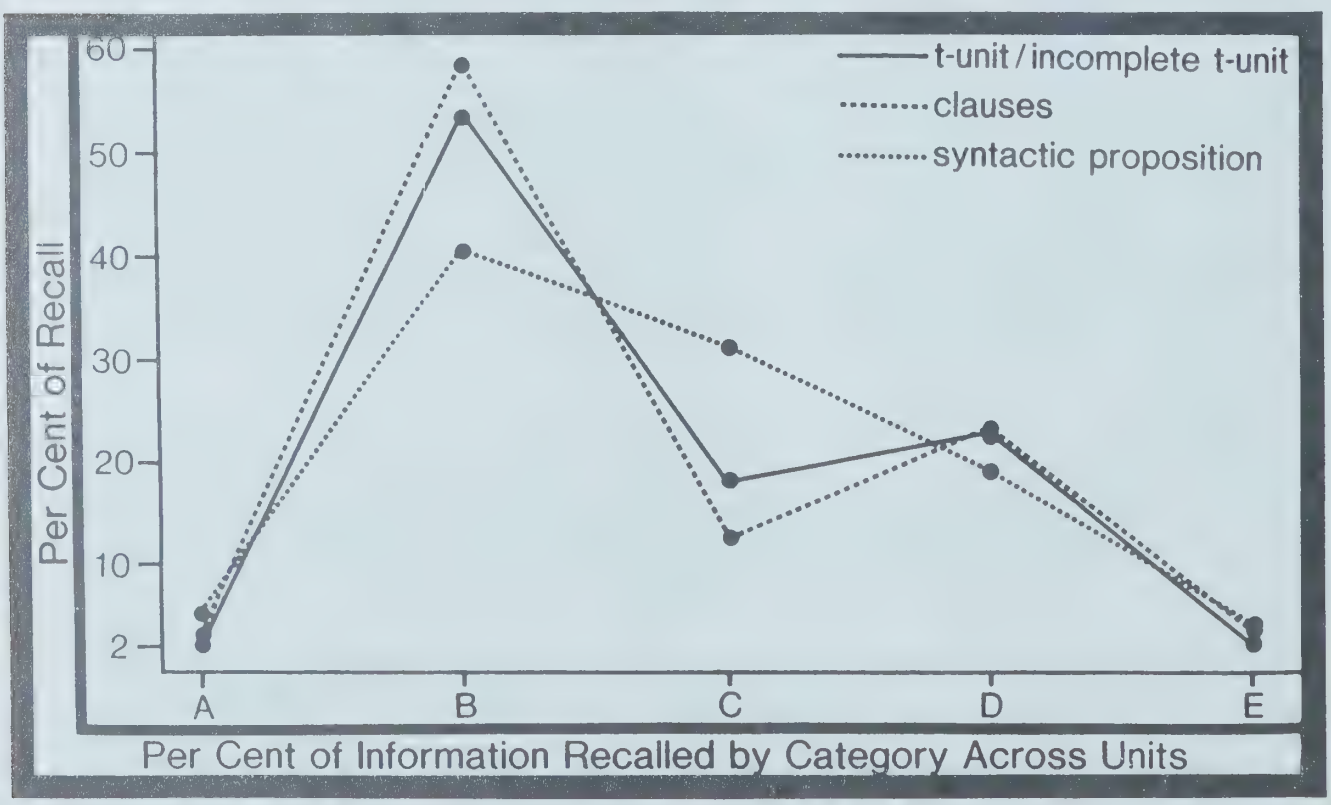


Figure 1.

Correlations

Table 3 provides a summary of the correlations between categories together with their levels of significance. An analysis of the data on this table shows that correlations between all categories based on the t-unit/incomplete t-unit and clause are significant beyond the .001 level. When categories are compared on the basis of t-unit/incomplete t-units and syntactic propositions, agreement between

three of the categories (B, C, E) fails to reach significance ($p<.05$). A similar comparison for the clause and syntactic proposition units reveal a lack of significant agreement between two of the categories (B, E).

TABLE 3

CORRELATIONS BETWEEN CATEGORIES OF COMPREHENSION BASED ON THREE UNITS OF ANALYSIS

A1/A2	.935(.00)	A1/A3	.604(.01)	A2/A3	.664(.01)
B1/B2	.871(.00)	B1/B3	.142(NS)	B2/B3	.189(NS)
C1/C2	.814(.00)	C1/C3	.466(.06)	C2/C3	.623(.01)
D1/D2	.928(.00)	D1/D3	.737(.00)	D2/D3	.822(.00)
E1/E2	.863(.00)	E1/E3	.193(NS)	E2/E3	.441(NS)

Note: 1 = t-unit/incomplete t-unit
2 = clause
3 = syntactic proposition

In summary it appears that the use of either the t-unit/incomplete t-unit or the clause as units of language analysis will result in similar mean and standard deviation sizes and a high degree of consistency in terms of the profile obtained when the units are assigned to a system of comprehension categories. The use of the syntactic proposition will give a slightly different profile.

A Profile of a Single Subject

The data for one subject chosen at random were graphed in order to demonstrate more clearly the implications of using different units of analysis for describing the comprehension recalls of readers. The data are presented in Figure 2. Consistent with the means of the group, there is little difference between the profiles obtained when information is assigned to comprehension categories on the basis of the t-unit/incomplete t-unit, and the clause. A different profile is produced when the syntactic proposition is used. Several differences may be noted. Consistent with expectation, there was more information assigned to Text Exact and less assigned to Text Erroneous than when the other two units of analysis were used. It is more likely that readers will remember smaller units in their exact form since there would be less stress on the capacity of rote memory. Similarly, it is less unlikely that readers will confuse smaller units of information as opposed to larger segments of the text. The other two categories where noticeable differences occurred were C (Text Entailed) and D (Text Experimental). The percentage of recall assigned to these was higher for C and lower for D than when recall was assigned on the basis of the other two units.

Discussion

The profiles obtained when recall information was assigned to comprehension categories on the basis of the t-unit/incomplete t-unit and the clause were more similar than when information was assigned on the basis of the syntactic

proposition. It was possible that the number of t-units/incomplete t-units in the recalls and the number of clauses were approximately equal. However a check showed that there were 502 t-units/incomplete t-units compared to 615 clauses. Consequently it seems that if either of these units were chosen for analysing recall data will produce similar results.

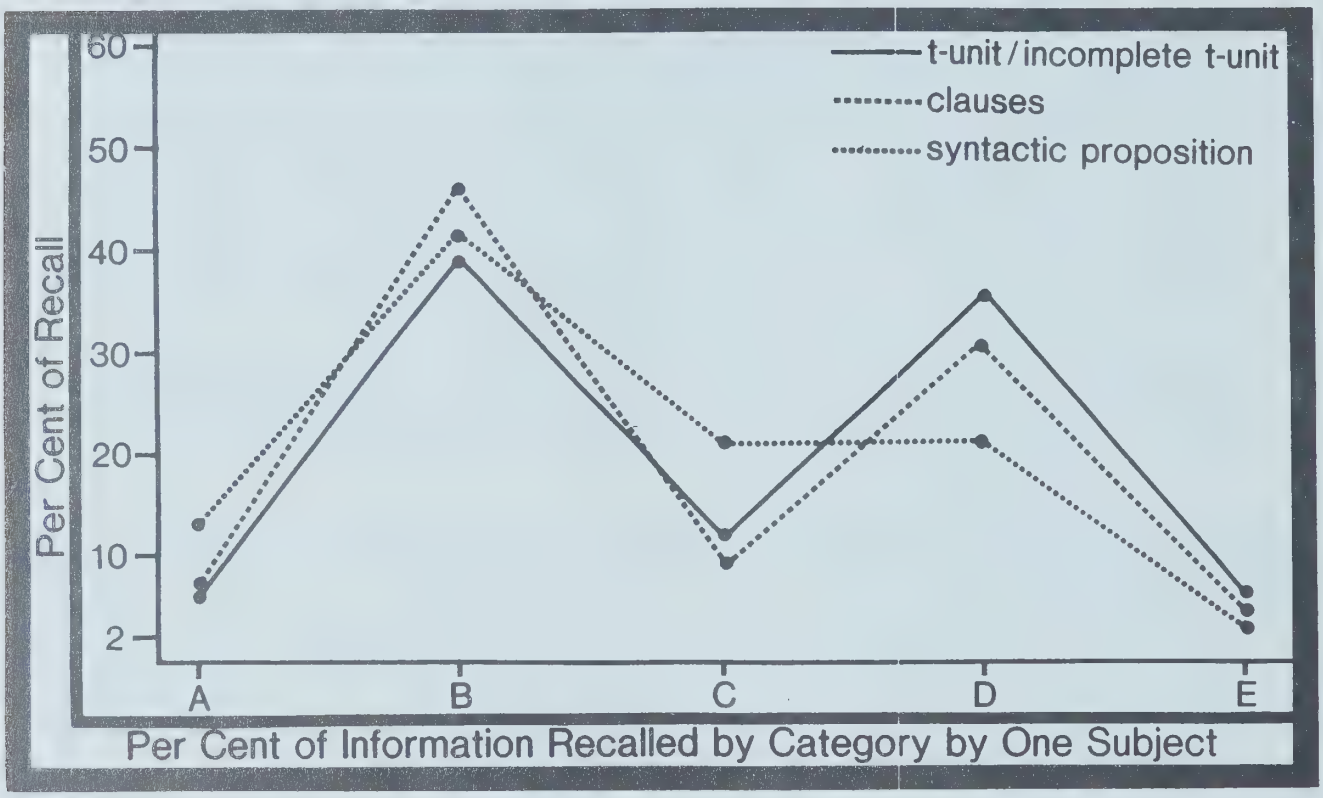


Figure 2.

The most striking difference among means for the three units was for Category C (Text Entailed). This was unexpected. Since this category involves the integration and synthesis of information from the text it was believed that the larger the unit chosen for analysis, the greater would be the mean of this category. However, the opposite situation occurred. To try and understand this result it is important to keep in mind that the unit of recall is the same as the text unit with which the recall is compared. Consider the examples below:

Text[3]: [1]*//He said to her/I should like to sit up and watch tonight/that we may see/who it is/that comes and does my work for me.* [2]*//They both liked the thought and made up their minds to try.* [3]*//So they left a light burning and hid themselves in the corner of a room behind a curtain.//*

Recall: *//Then he said/he would stay up and see/who comes and who does my work.//*

The single t-unit in the recall is roughly synonymous with the first text t-unit and thus would be categorized as Category B (Text Specific). The second clause in the recall is similar in meaning to "I should like to stay up and watch tonight" and would be classified as Category B. The second syntactic proposition in the recalls "he would stay up" is a synthesis (Category C) of the units "I should like" and "to sit up." The syntactic proposition "who comes" is a synthesis of "who it is" and

"that comes," and the syntactic proposition "and who does my work" is a synthesis of "who it is" and "that does my work for me." Thus by using the syntactic proposition, three units of the protocol would be assigned to Category C.

Another point that arises from these data is the small amount of information that was assigned to the Text Exact category. In a previous draft of these categories, this category was included with Text Specific and on the basis of the low means it might be suggested that they be recombined. However, one must keep in mind the purpose for which the analysis is going to be used. If it is going to be used for research and means alone are important, then separating the Text Exact category may not add a lot of information. However, should the analysis be used in a clinical diagnostic situation, then this category would help pinpoint those readers who try and regurgitate the text at a rote level. The spread of scores (percentages) of the 16 subjects for this category (0-12 for t-units/incomplete t-units, 0-9 for clauses, 0-13 for syntactic propositions) reflects the wide variation in this category.

The purpose of this study was to determine if differences occurred when recall data were assigned to categories on the basis of three units of analysis. This purpose was accomplished. However, a question that arises from these differences is which unit is the best to use. Since there were practically no differences between the t-unit/incomplete t-unit and the clause, the question is not between these but between these and the syntactic proposition. Since the study was not designed to answer this question and since the data do not provide an answer, the following points are based on speculation. The only significant correlations *within* the category system for each unit were between Text Exact and Text Specific ($p<.05$) for the t-unit/incomplete t-unit and clause, and between Text Exact and Text Entailed ($p<.01$)[4] for the syntactic proposition. It must also be remembered that this latter category contained a higher percentage of information for the syntactic proposition than for the other two units. The latter correlation is also easier to explain since one would expect that the more concerned children are with the exact wording of the text, and less likely they are to integrate and synthesize information. However, when these same children's protocols were analysed according to different units this correlation disappeared. One explanation is that since these other two units were larger, the exact portion (as defined by the syntactic proposition) was now subsumed within a larger unit which was considered a paraphrase (Text Specific) of the text unit. Thus classifying by the larger units eliminated much of the information being assigned to the Text Exact category. The example below will illustrate this.

Text: *//Once upon a time there was a shoemaker who worked very hard and was honest/but still he could not earn enough money to live on.//*

Recall: *//Once upon a time a shoemaker worked very hard but did not have enough to live on.//*

The syntactic proposition "to live on" is Text Exact information (Category A). However, when the t-unit/incomplete t-unit or clause are considered, this now loses its Exact status and within the larger units becomes a paraphrase of the text (Category B).

One decision that might be considered in deciding which unit to use is the nature of the profile desired. If a researcher or diagnostician wishes to give credit for integrating smaller units of information from the text, then the decision is in

favor of the syntactic proposition. The fact that the analysis of data based on this unit resulted in a significant negative correlation between Text Exact and Text Entailed information, which was theoretically predicted, would also be a plus factor. In addition, the syntactic proposition is defined syntactically and semantically; consequently, it may be more sensitive to the meaning structure of the recall.

A point that must be considered, however, is the time factor in learning and applying these units. The t-unit/incomplete t-unit and clause are more simply defined and easier to employ than is the syntactic proposition. In addition, the interrater reliability although respectable (90.3 percent agreement) was lower for this unit than for the other two. The comprehension categories for protocol analysis have been established as a productive system within discourse analysis for describing the nature of the information which readers recall after reading a text. The question of which unit of analysis to use in assigning data to these categories has not been resolved. One way in which to provide further insights into this matter is to obtain data on a larger sample of subjects within which there is greater variation among reading scores. Research has shown that good readers (Beebe, 1981) and readers who make gains in a remedial reading program (Kavanagh, 1981) use more Text Specific and Text Entailed information. It is possible that the comprehension profiles of different types of reader will change depending on the unit of analysis used and that one kind of unit will give the best profile for all groups.

Notes

1. Initially adjectives were treated as separate units but continued work with children seemed to indicate that the adjective is most often included with the noun as a single idea, hence the "adjective (adjective) noun" was considered a single syntactic unit.
2. The protocols that were analysed in this study were taken from a study completed by Cronin in 1980; the sample, etc. is described in terms of her study.
3. // = t-unit, / = clause, — = syntactic proposition, →means a syntactic proposition is continued.
4. This was in a negative direction

References

Bartlett, F.C. *Remembering*. London: Cambridge University Press, 1932.

Beebe, M.J. *A model of the relationships between reading strategies and reading comprehension*. Unpublished doctoral dissertation. The University of Alberta, 1981.

Brake, D. *An investigation of oral and silent reading with low and high achievers*. Unpublished master's thesis. The University of Alberta, Edmonton, 1981.

Clarke, C.D. *A comparison of the unaided recalls of able and less able readers*. Unpublished master's thesis. The University of Alberta, Edmonton, 1981.

Cronin, M.C. *The relationship of story grammar to recall of grade six Cree students*. Unpublished master's thesis. The University of Alberta, Edmonton, 1980.

Drum, P.A. *Between sentence factors and the effects upon reading rate and recall*. Unpublished doctoral dissertation. Stanford University, 1974.

Drum, P.A., & Lantaff, R.E. Scoring categories for protocols. Paper presented at the Second Annual Conference, Boston, October, 1977.

Fagan, W.T. A comparison of the oral language of children ages nine, ten, and eleven. *A Research Report, Canada Council Grant S76-0563*. The University of Alberta, Edmonton, Alberta, 1978.

Fagan, W.T. Comprehension categories for protocol analysis. In W.T. Fagan, C. Cooper, & J. Jensen (Eds.), *Measures for research and evaluation in the English language arts*, Volume 2. Urbana, Illinois: National Council of Teachers of English, in press.

Frederiksen, C.H. Representing logical and semantic structure of knowledge acquired from discourse. *Cognitive Psychology*, 1975, *7*, 317-458.

Grimes, J.E. *The thread of discourse*. Ithaca: Cornell University, 1972.

Hunt, K.W. Grammatical structures written at three grade levels. Urbana, Illinois: National Council of Teachers of English, 1965.

Kavanagh, M.B. Processing differences on three reading levels between gain groups and no gain groups in a remedial reading situation. Unpublished masters research project. The University of Alberta, Edmonton, 1981.

Kintsch, W. Notes on the structure of semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory*. New York: Academic Press, 1972.

Kintsch, W. *The representation of meaning in memory*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1974.

Kintsch, W. On comprehending stories. Paper presented at the Carnegie Symposium on Cognition, May 1976.

Loban, W. Language development: Kindergarten through grade twelve. Urbana, Illinois: National Council of Teachers of English, 1976.

Machura, S. Comprehension of perceptual connectives. Unpublished masters thesis. The University of Alberta, Edmonton, 1981.

Mandler, J.M., & Johnson, N.S. Remembrance of things parsed: Story structure and recall. *Cognitive Psychology*, 1977, *9*, 111-151.

Meyer, B.J.F. & McConkie, G.W. What is recalled after hearing a passage? *Journal of Educational Psychology*, 1973, *65*, 109-117.

Meyer, B.J.F. *The organization of prose and its effects on memory*. Amsterdam: North Holland, 1975.

Meyer, B.J.F. The structure of prose: Effects on learning and memory and implications for educational practice. In R.C. Anderson, R.J. Spiro, & W.E. Montague (Eds.), *Schooling and the acquisition of knowledge*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1977.

Rumelhart, D.E. Understanding and summarizing brief stories. (Technical Report No. 58). San Diego, California: Center for Human Information Processing, University of California, San Diego, 1976.

Stein, N.L., & Glenn, C.F. An analysis of story comprehension in elementary school children. In R. Freedle (Ed.), *Discourse processing: Multidisciplinary perspectives*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1978.

Strickland, R. The language of elementary school children: Its relationship to the language of reading textbooks and the quality of reading of selected children. Bulletin of the School of Education, Indiana University, 1962.

Thorndyke, P.W. Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology*, 1977, *9*, 77-110.

Turner, A., & Green, E. *The construction and use of a propositional text base.* Technical Report No. 63. Institute for the Study of Intellectual Behavior, University of Colorado, Boulder, 1977.

van Dijk, T.A., & Kintsch, W. Cognitive psychology and discourse: Recalling and summarizing stories. In W.U. Dressler (Ed.), *Trends in text linguistics*. New York: de Fruyter, 1976.

Zinn, C. *A comparison of high and low grade four readers on their use of the logical connectives "because."* Unpublished master's thesis. The University of Alberta, 1979.

The Alberta Journal of Educational Research *Volume XXIX, No. 2, June, 1983, 110-122*

KEVIN MARJORIBANKS
University of Adelaide

Occupational Situs, Family Learning Environment and Children's Academic Achievement

This study examined the utility of adopting occupational situs categories in educational research by investigating relations between occupational status, family learning environments and children's academic achievement, for families from different occupational situses. Included in the sample were 900 Australian families divided into 10 occupational situses, where a situs was defined by the functional, rather than hierarchical, similarity of occupations. Discriminant analysis indicated separation among the situses in relation to two environment dimensions labelled family individualism and structured-achievement training. Regression surface analysis revealed that the environment dimensions and occupational status had differential associations with children's word-test performance, for families of different situses. The findings suggested that the type of learning environment created by families is related both to parents' occupational status and to the meanings that persons attach to their work activity.

One of the most consistent findings in educational research is that parents' occupational status is related to children's school achievement. Occupational indices in the form of single hierarchical status or prestige dimensions represent, however, a limited description of occupations. Our understanding of how parental occupations are associated with children's school outcomes may be enriched if other occupational measures were included in analyses. Cain and Treiman (1981, p. 253) have suggested, for example, that in sociological research "there has been increasing interest in expanding the repertory of occupational variables to include dimensions other than prestige and socioeconomic status." They claim that such interest derives from a

---

Kevin Marjoribanks (MA, Harvard; PhD, Toronto) is the Professor of Education, University of Adelaide, Australia. At present he is conducting a longitudinal investigation of relations between family and classroom learning environments and school outcomes for children from different social status and ethnic groups.

> recognition that other hierarchical dimensions such as power and authority are implicated in status attainment; a greater concern with structural features on inequality, often informed by Marxian or market-segmentation perspectives; and increasing interest in the intrinsic content of occupational roles. (p. 253)

It has also been proposed (Morris & Murphy, 1959; Murphy & Morris, 1961; Samuel & Lewin-Epstein, 1979) that investigations of occupational structure should examine separate categories, based on the functional similarity of occupations, to explore non-stratified aspects of occupations. Such qualitative, rather than hierarchical, categories have been labelled as occupational situses, where "a situs includes all those jobs, occupations, and professions which share a common function, mission, or focus of activity" (Samuel & Lewin-Epstein, 1979, p. 627). In discussing the potential utility of situs categories, Morris and Murphy (1959, p 239) proposed that "the functional context of an occupation may make as much difference for the behavior or life style of the incumbent as the general prestige or socio-economic level of that occupation."

By adopting situs categories in educational research, occupations could be examined in relation to a vertical dimension defined by status and an horizontal dimension defined by situs. The introduction of such situs measures should be considered as a means of potentially increasing our understanding of the links between occupational structure and children's school behaviors rather than being regarded as a "competitor" to occupational status indices. It is realized, of course, that occupation forms only one element of family social context and that a more complete analysis of family social status would require an examination of measures such as parental education and family income. This study is limited to an examination of occupations. In the analysis, situs categories were included to examine: (a) relations between occupational situs and family learning environments, and (b) to what extent associations between occupational status, family learning environments, and children's academic achievement varied for families from different occupational situses.

Method

Sample

The data for the study were collected from 900 Australian families. Each family had an 11-year-old child attending an urban elementary school and the analyses related to those children. Findings from the investigation need to be interpreted within the limitation that the sample was not random. Attempts were made throughout the analyses, however, to make adjustments for the design effects of the sample. Jackknife estimates were based on four subsamples formed by randomly allocating families to the four groups. Pseudo-values for statistics were obtained from four sets of computations. In successive analyses different combinations of subsamples, taken three at a time, were used. Significance levels were then adjusted using the formula: standard error of sample estimate = (design effect)$^{1/2}$ x simple random standard error (Kish, 1965; Ross, 1976). Also, the relatively small sample sizes within occupational situs categories prevented separate multivariate investigations of family learning environments for girls and boys, which was a further restriction of the study.

Measures

Occupational situs.

> The assumptions underlying the situs conception are that occupations contribute to the fulfillment of a certain societal function, and that each function as such is equally necessary to the integrity of society. Hence, an overall situs classification of a given labor force in essence depicts the functional division of that society — above and beyond its diversification by income, authority, or prestige levels. (Samuel & Lewin-Epstein, 1979, p. 627)

Following this conception, Morris and Murphy (1969) and Samuel and Lewin-Epstein (1979) divided the occupational domain into 10 major situs categories, which were adopted for the present study. The situs categories were labelled: (l) legal authority — all those occupations concerned primarily with the formulation, arbitration, interpretation, and enforcement of the law (e.g., lawyer, the police); (2) finance and records — those occupations concerned with the handling of monetary affairs, accounts, or correspondence (e.g., clerk, secretary, teller, bookkeeper); (3) manufacturing — occupations involved with the fabrication of articles or processing of raw material on a production-line basis (e.g., production engineer, machine operator, quality-control expert, assembly-line worker); (4) transportation — all occupations concerned primarily with the movement of persons or goods from one location to another (e.g., navigator, bus driver, conductor, porter); (5) extraction — occupations involved in the extraction, procurement, or production of raw materials (e.g., farmer, geologist, miner, oil driller); (6) building and maintenance — all occupations concerned primarily with the construction of buildings or the installation, maintenance, and repair of equipment, property, and facilities (e.g., architect, bricklayer, repairperson, custodian, janitor); (7) commerce — those occupations related to the buying, selling, exchange, or marketing of goods or persons (e.g., exporter, car dealer, realtor, salesperson); (8) aesthetics and entertainment — all occupations associated primarily with the creation of art forms or with the provision of entertainment, recreation, information, or aesthetic satisfaction for the public (e.g., composer, impresario, reporter, performer); (9) education and research — those occupations related to formal instruction, training, or with the acquisition of knowledge (e.g., school teacher, experimentalist, college instructor); (10) health and welfare — all occupations concerned primarily with the detection, prevention or alleviation of illness, hazard, or distress (e.g., physician, therapist, social worker).

During interviews with parents, each respondent provided a detailed description of her or his occupation. Approximately half the mothers indicated that they were not involved in an occupation outside the family. Therefore, it was decided, where possible, to define occupational situs and status in relation to the occupations of fathers. In 65 families without fathers, mothers' occupations were used for the classification. An occupational scale developed at the Australian National University (Broom, Duncan-Jones, Lancaster Jones, & McDonnel, 1977) was used to categorize each occupation. The scale which is labelled the 'ANU-2 scale' includes descriptions of more than 400 occupations. The number of families classified into each situs category were: legal, 26; finance, 38; manufacturing, 204; transportation, 51; extraction, 136; building, 240; commerce, 115; aesthetics, 21; education, 44; and health and welfare, 25. Occupational status was also defined in relation to the categories of the ANU-2 scale.

Family learning environment. A social-psychological framework developed by Rosen (1956, 1959, 1961) for the study of achievement-oriented families was adopted as the basis for constructing a family learning environment schedule.

Rosen proposed that family learning environments could be characterized by variations in the interrelated components of achievement training, independence training, achievement-value orientations, and educational-occupational aspirations. Achievement training was defined as that socialization process in which "parents, by imposing standards of excellence upon tasks, by setting high goals for their child, and by indicating their high evaluation of his (her) competence to do a task well, communicate to him (her) that they expect evidences of high achievement" (1959, p. 50). For independence training, it is assumed that parents indicate to their children that they expect them to be self-reliant at the same time granting their children relative autonomy in decision-making situations. Therefore, while achievement training attempts to teach children to do things well, independence training tries to teach children to do things on their own. It was proposed by Rosen (1956) that these two family socialization practices act together to generate achievement motivation which provides children with the internal psychological impetus to excel in situations involving standards of excellence. Achievement-value orientations were defined as "meaningful and affectively charged modes of organizing behavior-principles that guide human conduct. They establish criteria which influence the individual's preferences and goals" (Rosen, 1959, p. 53). Rosen stated, however, that while achievement motivation and value orientations affect individuals' achievement by influencing their need to excel and their willingness to plan and work hard, they "do not determine the areas in which such excellence and effort takes place" (1959, p. 57). It was proposed that unless parents expressed high educational and occupational goals for their children, then the other socialization processes would not necessarily be associated with successful achievement. The family learning environment defined by the interaction of the four socialization processes was labelled by Rosen as the achievement syndrome.

A family environment schedule, in the form of a semi-structured parent-interview inventory, was constructed for the present study. The schedule assessed the following six dimensions: achievement orientation, press for English, press for reading, press for independence, individualistic-collectivistic value orientations, and parents' educational-occupational aspirations for their children. The concept, press, was adopted from Murray (1938, p. 16), who in his theory of personality suggested that if the behaviour of individuals was to be understood then it was necessary to devise a method of analysis that would "lead to satisfactory dynamical formulations of external environments." He proposed that an environment should be classified by the kinds of benefits or harms that it provided. If the environment had a potentially harmful effect, Murray suggested that individuals attempted to prevent its occurrence by avoiding the environment or defended themselves against it, while if the environment had a potentially beneficial effect then individuals would typically approach the environment and attempt to interact with it. The directional tendency of the environment implied in Murray's framework was designated as the press of the environment. Each press is defined as having a qualitative aspect which is the kind of affect that the environment has or might have upon an individual. Also each press has a quantitative aspect which is assessed by the variation in power that an environment has for either harming or benefiting individuals. In the present analysis, the first three environment dimensions identified were used to measure achievement training in families. In Rosen's analyses the language context of families was not included as part of the achievement syndrome. It was considered, however, that an assessment of the language environment of families would make

the achievement syndrome a more sensitive construct (see Marjoribanks, 1979, 1980).

Factor scaling techniques were used to develop scales to gauge the six dimensions of the family environment typology (Armor, 1974). Family environment scores for each child were obtained by adding the scores on those items making up each of the dimensions. Theta reliability estimates of the final scales were greater than 0.75. In the achievement-orientation scale were questions such as: How much time do parents expect their child to devote to homework or schoolwork at home; How often do parents praise their child for work done at school; and How often do parents discuss their child's progress at school. The press for English dimension consisted of items of the form: How often would you help your child with English grammar (e.g., tell the child how to construct sentences, when to use certain words); How particular would you say you are about the way your child speaks English (correct grammar, good vocabulary). Press for reading did not relate to any particular language and the scale included items such as: How many books do parents read in a month, When the child was small how often did the parents read to her/him, and How many books does the child bring home from libraries each month. Press for independence was measured using items in which parents indicated the age they would allow their child to undertake certain activities. The individualistic-collectivistic achievement-value orientation scale consisted of items similar to those used by Strodtbeck (1961) to measure independence of family and they were of the form: Even when a girl (boy) gets married her (his) main loyalty still belongs to her (his) parents; When the time comes for a daughter (son) to take a job, she (he) should try and stay near her (his) parents, even if it means giving up a good opportunity, and Nothing in life is worth the sacrifice of moving away from one's parents. The parents' aspirations scale included items of the form: How much education do you want your child to receive; How much education do you really expect your child to receive; and What kind of job would parents really like their child to have. Interviewing in homes was conducted by government social survey interviewers (see Marjoribanks, 1982a, 1982b).

Academic achievement. Standardized tests devised by the Australian Council for Educational Research were used to assess children's achievement in word knowledge and word comprehension (Primary Reading Survey Tests) and in mathematics (Class Achievement Tests in Mathematics). In an attempt to create as uniform test-taking contexts as possible, I administered the test program in the children's classrooms.

Results

(a) *Occupational situs and family learning environments.*

Environmental differences among the 10 situs categories were examined using discriminant analysis, which as Nunnally (1967, p. 373) has suggested is a method of profile analysis that allows hypotheses to be tested "about the extent to which a priori groups 'hang together'." Two discriminant functions were identified as having significant discriminatory power among the occupational situses. The first function was interpreted as an individualism dimension as it was defined substantially by individualistic-collectivistic value orientations and, to a lesser extent, by press for independence. Press for English, press for reading, and

achievement orientations defined the second function which was labelled as a structured-achievement training dimension.

In Figure 1, the group centroids in relation to the two discriminant dimensions are presented, where "a centroid is simply the point representing the average profile of a group" (Nunnally, 1967, p. 390). The first function reflected a strong separation between the environment profiles of the manufacturing-situs category and the occupational groups of transport, health and welfare, education, and finance. There was a modest separation among the situses for the second discriminant function, with the legal and manufacturing groups exhibiting the most significant separation.

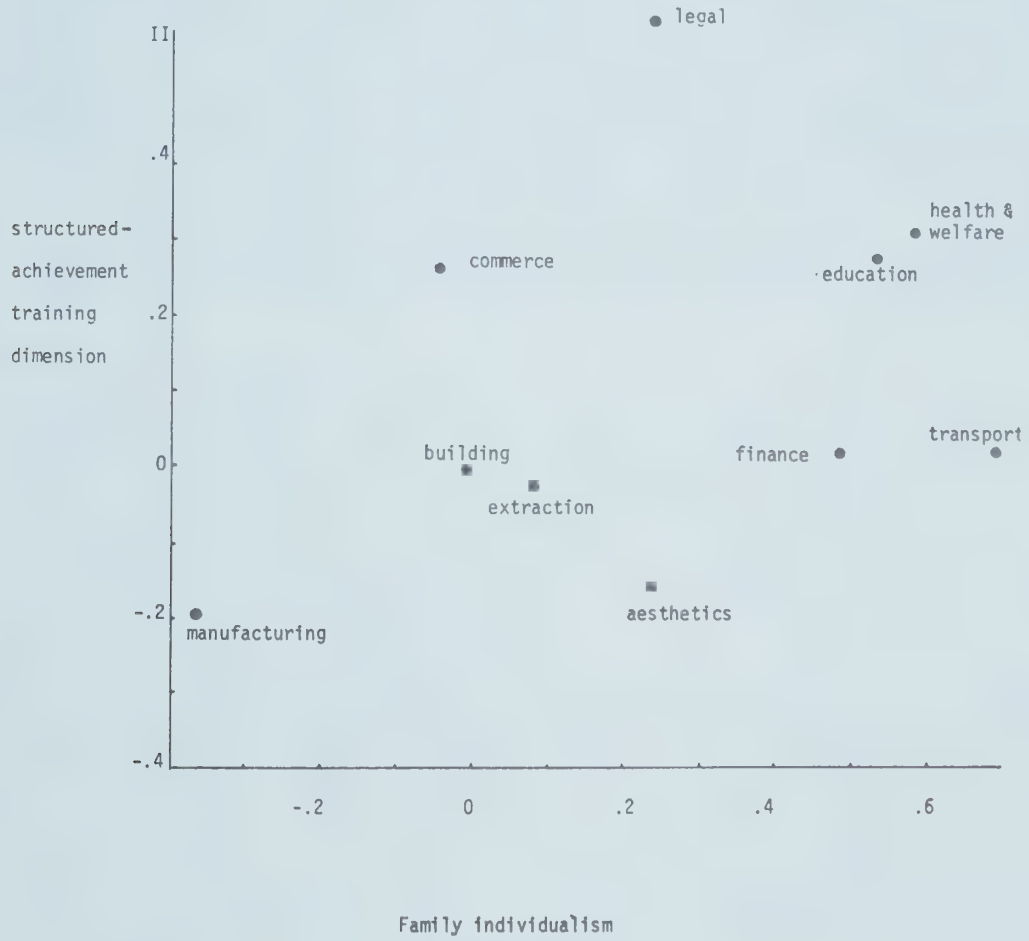


Figure 1. Situs centroids in relation to family environment discriminant dimensions.

A social status measure, which was a combination of occupational status and the education level of parents, was adopted to examine whether there were mean differences in the social status of situs categories. The results indicated, for example, that while there were no significant differences in the mean social-status scores of the transport, commerce, extraction, building, and manufacturing categories there were significant differences between the environment centroids for those situses. In Figure 2, the profiles of mean environment scores for those five situses are presented to indicate further the nature of the situs-group differences in family environments. Scores were standardized with means of 50 and standard deviations of 10, calculated over the total sample. Parents in the transport category, for example, were characterized by modest aspirations, relatively strong press for English and reading, positive achievement orientations, moderate press

for independence, and highly individualistic-achievement value orientations. Parents from the commerce situs had a similar environment pattern but with less individualistic orientations and lower press for reading. In contrast, the manufacturing-situs families expressed modest aspirations, low press for English and reading, negative achievement orientations, weak press for independence, and strong collectivistic value orientations. The environment scores in the building and extraction situses reflected the presence of relatively modest achievement-oriented family learning environments.

In multiple regression models, where the situs data formed a set of mutually exclusive categories and the environment dimensions were the criterion measures, occupational situs was typically associated with modest percentages of the variance in the environment scores, when calculated over the total sample. Multiple correlations between occupational situs and environment dimensions were: press for English, 0.31; press for reading, 0.22; achievement orientations, 0.23; press for independence, 0.20; and achievement-value orientations, 0.23. Parents' aspirations were not related to occupational situs. Overall, the initial findings of the analysis provided support for the proposition that parents from different occupational situs categories created different learning environments for their children.

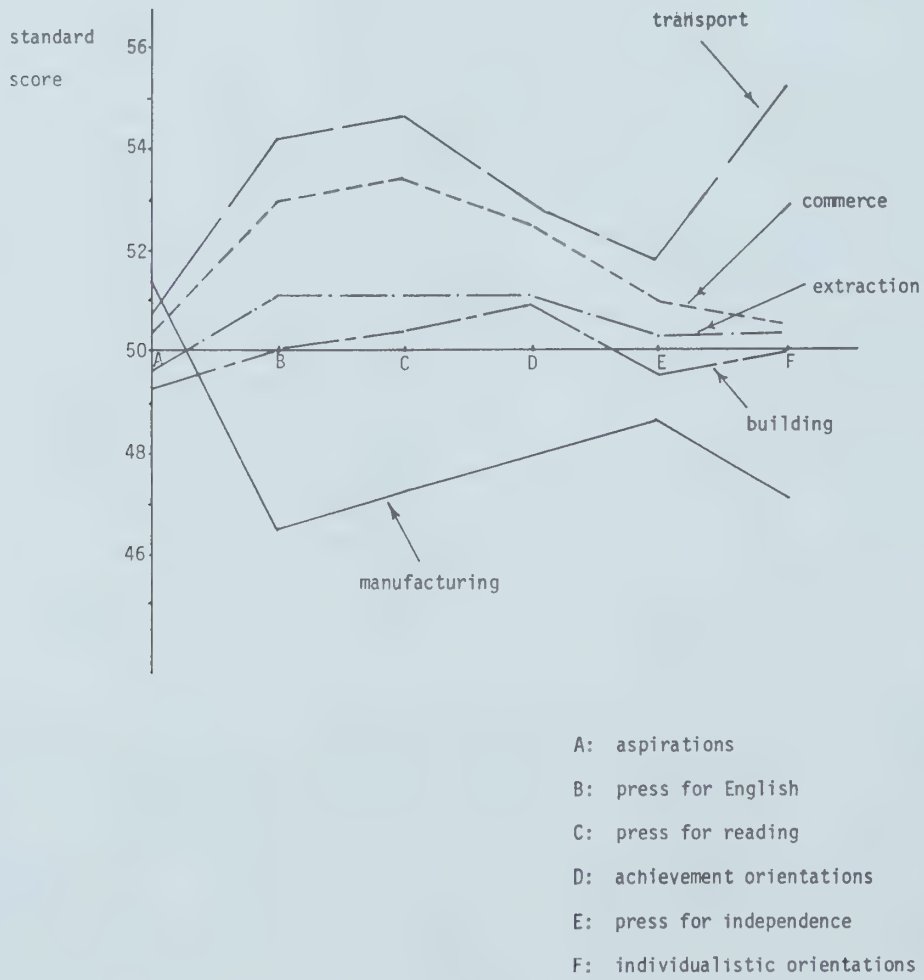


Figure 2. Situs-patterns of family environment dimensions.

(b) *Situs, status, family environment and children's achievement*

The utility of adopting occupational situs categories in educational research was investigated further by examining relations between occupational status, family learning environments and children's academic achievement for families from different occupational situses. Regression surfaces were plotted to examine the associations. Previous reseach has suggested that environment measures may be related differentially to children's achievement at various levels of social status and that changes in environments may be associated with variations in children's achievement only until environment threshold levels are attained. Therefore, interaction and curvilinear (squared) terms were included in the regression models used to generate the response surfaces. Two-stage hierarchial regression analyses were adopted to generate raw regression weights that were used to plot the planes. In stage one, predictors were introduced successively in the order: occupational status, family environment, occupational status-environment interaction, $(\text{status})^2$, and $(\text{environment})^2$. That is, the regression equations were of the form:

$$Y = aX + bZ + cXxZ + dX^2 + eZ^2 + \text{constant},$$

where Y, X, and Z represented measures of academic achievement, occupational status, and family environment, respectively. As Cohen (1978, p. 863) has suggested,

> when we linearly partial from the product its constituents, we have an interaction, for example X x Z = XZ · X, Z. Similarly, when we linearly partial from an integral power its constituent(s), we have a curve component, for example X x X = XX · X. Further, just as XZ · X, Z is necessarily orthogonal to X and Z, whatever the correlations among X, Z, and XZ, so, too, is X^2 · X necessarily orthogonal to X, whatever the correlation between X and X^2 (usually close to unity). Partialed variables (residuals) correlate precisely zero with the variables that have been partialed from them, by construction (or definition).

That is, an XxX interaction ($X^2 \cdot X$) can be interpreted as meaning that the slope of the Y on X regression lines varies as X varies. Polynomials may be analyzed in hierarchical regression equations with "linear functions preceding quadratic preceding cubic, and so on, and with main effects preceding two-way preceding three-way interactions, and so forth, so that terms of lower order are partialed from those of higher order and not vice versa" (Cohen, 1978, p. 866). In the second-stage of the hierarchical regression analyses, interaction and squared terms not related to achievement were deleted from the models and associations between achievement and the remaining predictors were recalculated.

For the analysis, word knowledge and word comprehension were combined into a composite word-test score. Also, from the findings of the discriminant analysis two family environment measures were generated. These were labelled family individualism, a combination of achievement value orientations and press for independence; and structured-achievement training, a composite of press for English, press for reading, and achievement orientations. The regression surface analysis was conducted in the four occupational situses of building, commerce, extraction, and manufacturing. These occupational categories had similar distributions of occupational status and had sufficient families to permit multivariate analysis.

TABLE 1

RELATIONS BETWEEN OCCUPATIONAL STATUS, FAMILY ENVIRONMENT AND ACADEMIC ACHIEVEMENT WITHIN DIFFERENT OCCUPATIONAL SITUS CATEGORIES

	Occupational Situs							
	Manufacturing		Extraction		Building		Commerce	
Predictor Variables	Word	Math	Word	Math	Word	Math	Word	Math
Occupational	1.364[a]	.717	.994	.698	7.616	.444	8.121	1.223
Status	.098	.052	.038[b]	.018[b]	.076	.025	.079	.092
Achievement	.127	.049	.043	-.045	.375	.031	.782	.010
Training	.016	.005[b]	.002[b]	.005[b]	.019	.002[b]	.001[b]	.001[b]
Status X	c	c	c	c	.109	c	-.060	c
Training					.025		.033	
(Status)²	c	c	c	c	-.316	c	c	c
					.032			
Multiple R	.339***	.238**	.200	.151	.388***	.163*	.334**	.303**
Occupational	-8.441	.858	.719	.580	4.619	.211	1.910	1.223
Status	.098	.052	.038[b]	.018[b]	.076	.025	.079	.092
Individualism	-1.309	.009	.357	-.032	.230	.300	.024	.042
	.001[b]	.001[b]	.035	.001[b]	.077	.051	.001[b]	.001[b]
Status X	.150	c	c	c	c	c	c	c
Individualism	.079							
(Status)²	c	c	c	c	-.212	c	c	c
					.030			
Multiple R	.422***	.228**	.270**	.135	.430***	.274***	.280**	.304**

Notes. [a] Raw regression weights are uppermost in each pair of numbers while lowermost is the amount of variance associated with the addition of each predictor to the regression.

[b] The variance associated with the addition of the predictor is not significant.

[c] Variables not included in the second stage of the hierarchical regression analyses.

* $p < .05$

** $p < .01$

*** $p < .001$

Regression surfaces were constructed using the raw regression weights in Table 1. Typically, within each situs category, occupational status and the family environment measures combined to have modest relations to the word-test scores. Mathematics achievement, however, tended not to be associated with the environment measures at different levels of occupational status. Only in the building category was (occupational status)^2 associated with an increase in the variance of word-test scores while (environment)^2 was not related uniquely to the achievement measures in any of the situs categories. As it was not possible to present all the regression surfaces generated for the study, six surfaces have been plotted in two figures. The surfaces represent the major situs-group differences in relations among the measures. In the figures, scores were standardized with means of 50 and standard deviations of 10. The surfaces in Figure 3 show the regression-fitted relations between family individualism and word-test scores at different levels of occupational status, for families from the manufacturing, extraction, and building situses. The shape of the surface for the manufacturing situs reflects the presence of a significant interaction between occupational status and family individualism. At low status levels, increases in family individualism were associated with decrements in word-test scores while at high status levels, increasing individualism was related to increments in word performance. That is, in the low status manufacturing-situs families there appeared to be a conflict between increasing individualism and children's word achievement. In contrast, for high status manufacturing-situs families, increased individualism was related strongly to increased word-test performance. For extraction-situs families, increases in individualism scores were associated with increments in word-test achievement at each level of occupational status, while at each environment value there was no relation between status and achievement. In the building situs, word performance had significant linear associations with occupational status and family individualism, and also significant curvilinear relations to occupational status. At each status level, for example, regression-fitted word-test scores increased by approximately 10 points over the range of individualism values.

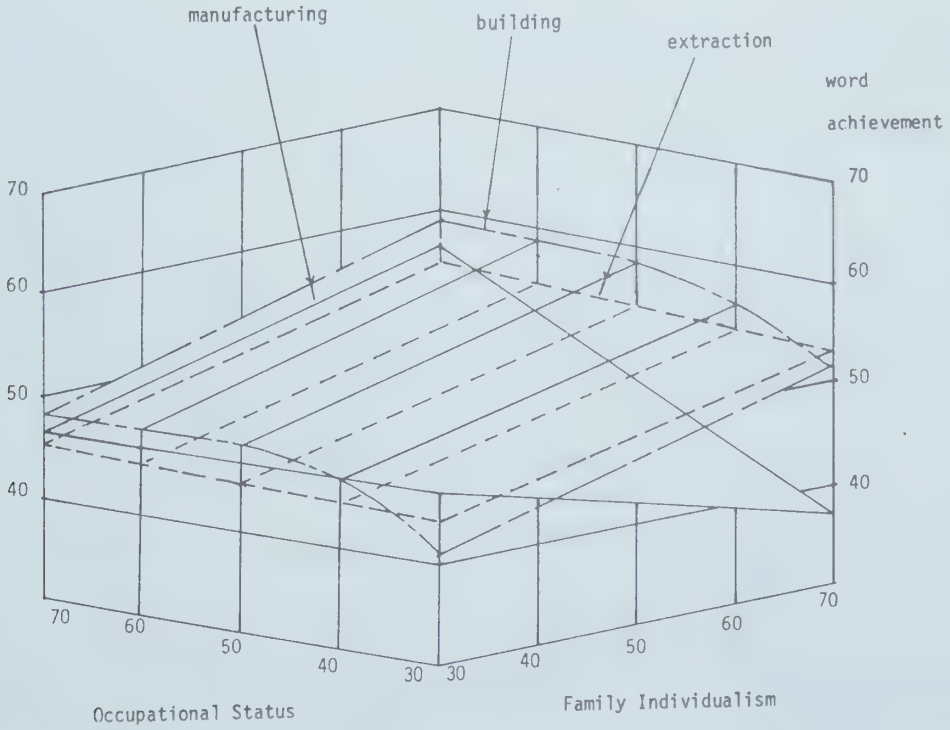


Figure 3. Fitted-word scores in relation to occupational status and family individualism.

Increases in occupational status at each environment level, however, were related to increments in achievement scores only until a threshold level of status was attained. After that threshold level, approximately 50, further increases in occupational status were not associated with changes in word achievement. Thus the regression surfaces in Figure 3 indicated that family individualism and occupational status were related differentially to word-test achievement, for families from different occupational situses.

In Figure 4, the surfaces show the regression-fitted relations between structured-achievement training, occupational status, and word-test achievement for families from the building, manufacturing, and commerce situses. Again, the surfaces revealed that the environment and status measures had different associations with achievement within the various situses. For manufacturing-situs families, increases in occupational status were related to similar increments in the word scores at each environment level. In contrast, for building-situs families, occupational status had a negatively increasing association with achievement while for commerce-situs families, status and achievement were related at low environment values but not at high achievement training scores. Also, the shapes of the surfaces indicated that at each level of occupational status, increases in structured-achievement training were associated with increments in the regression-fitted word-test scores for the building and manufacturing situses, but the associations in the commerce situs were significant only at low status levels.

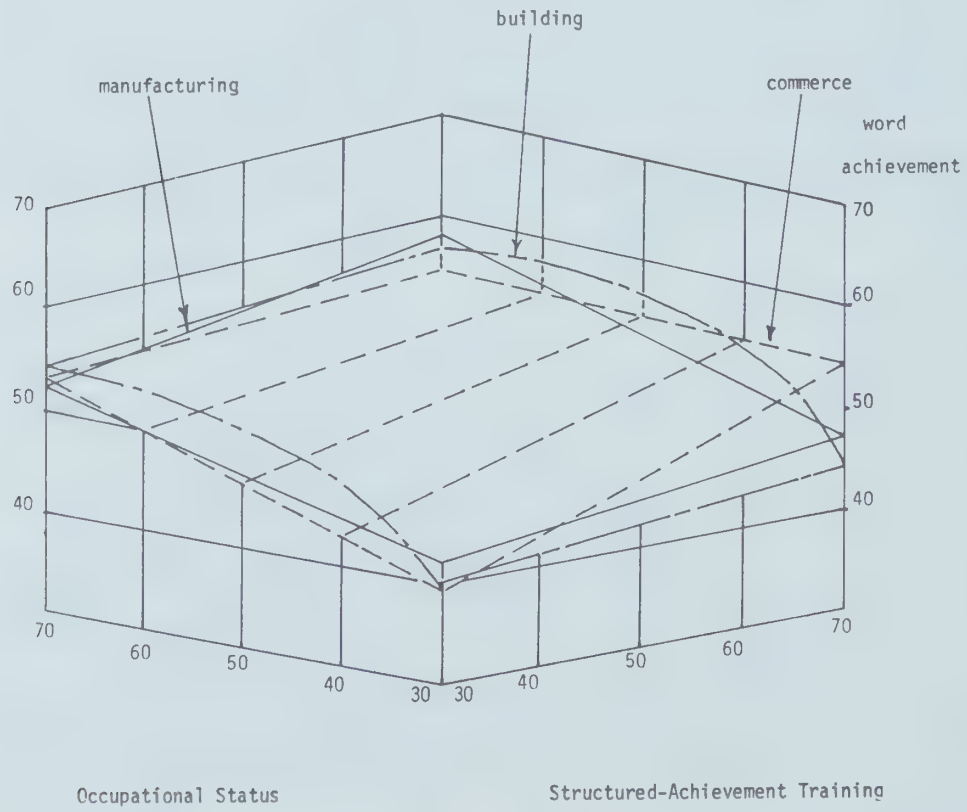


Figure 4. Fitted-word scores in relation to occupational status and structured-achievement training.

Discussion

Typically, research has shown that measures of family learning environments and occupational status are related to children's academic achievement. It has been suggested, however, that it may not be valid to generalize such findings for families from different ethnic groups (e.g., see Walberg & Marjoribanks, 1976; Clarke-Stewart & Apfel, 1978; Marjoribanks, 1980). The present analysis also suggests caution in generalizing such findings for families of different occupational situses.

The concept of occupational situs assumes that the meanings and functions that persons attach to their work activity influence their attitudes and behaviours, both inside and outside work situations. This study suggests that the type of learning environment created in families is related both to parents' occupational status and to the meanings that persons attach to their work activity. Therefore, educational research that investigates the social circumstances surrounding children's school-related behaviours might be enriched by examining the status and situs characteristics of occupations. Bloom (1980, p. 15) has proposed that "there is a curriculum and teaching style in each home and that it is the variations in the home curriculum and teaching which account for much of the differences in children's preparation for the learning tasks in the school." Research is now required which examines the meanings that workers give to their work activity and how such meanings are related to the curriculum and teaching styles adopted in families. When such research is completed it is likely that our theoretical understanding of relations between occupational structure and children's school behaviour will be greatly enhanced.

References

Armor, D.J. Theta reliability and factor scaling. In H.L. Costner (Ed.), *Sociological methodology, 1973-1974.* San Francisco: Jossey-Bass, 1974.

Bloom, B.S. The new direction in educational research: Alterable variables. In K.D. Sloane & M.L. O'Brien (Eds.), *The state of research on selected alterable variables in education.* Chicago: University of Chicago, 1980.

Broom, K., Duncan-Jones, P., Lancaster Jones, F., & McDonnel, P. *Investigating social mobility.* Canberra: Australian National University Press, 1977.

Cain, P.S., & Treiman, D.J. The Dictionary of Occupational Titles as a source of occupational data. *American Sociological Review*, 1981, *46*, 253-278.

Clarke-Stewart, K.A., & Apfel, N. Evaluating parental effects on child development. In L.S. Shulman (Ed.), *Review of research in education.* Itasca, Illinois: Peacock, 1978.

Cohen, J. Partialed products *are* interactions; partialed powers *are* curve components. *Psychological Bulletin*, 1978, *85*, 858-866.

Kish, L. *Survey sampling.* New York: Wiley, 1965.

Marjoribanks, K. *Families and their learning environments.* London: Routledge and Kegan Paul, 1979.

Marjoribanks, K. *Ethnic families and children's achievements.* London: Allen and Unwin, 1980.

Marjoribanks, K. Sibling and family environment correlates of children's achievement: Ethnic group differences. *Journal of Biosocial Sciences*, 1982, *14*, 99-107. (a)

Marjoribanks, K. Fifteen thousand hours: A related study of family-school differences. *Educational Studies (England)*, 1982, *8*, 45-53. (b)

Morris, R., & Murphy, R. The situs dimension in occupational literature. *American Sociological Review*, 1959, *24*, 231-239.

Murphy, R.J., & Morris, R.T. Occupational situs, subjective class identification, and political affiliation. *American Sociological Review,*, 1961, *26*, 383-392.

Murray, H. *Explorations in personality*. Oxford: University Press, 1938.

Nunnally, J.C. *Psychometric theory*. New York: McGraw Hill, 1967.

Rosen, B.C. The achievement syndrome: A psychocultural dimension of stratification. *American Sociological Review*, 1956, *21*, 203-211.

Rosen, B.C. Race, ethnicity, and achievement syndrome. *American Sociological Review*, 1959, *24*, 47-60.

Rosen, B.C. Family structure and achievement motivation. *American Sociological Review*, 1961, *26*, 574-584.

Ross, K.N. *Searching for uncertainty*. Melbourne: Australian Council for Educational Research, 1976.

Samuel, Y., & Lewin-Epstein, N. The occupational situs as a predictor of work values. *American Journal of Sociology*, 1979, *85*, 625-639.

Strodtbeck, F.L. Family interaction, values and achievement. In A.H. Halsey, *et al.* (Eds.), *Education, economy, and society*. New York: Free Press, 1961.

Walberg, H.J. & Marjoribanks, K. Family environment and cognitive development: Twelve analytic models. *Review of Educational Research*, 1976, *46*, 527-551.

The Alberta Journal of Educational Research *Volume XXIX, No. 2, June, 1983, 123-130*

WAYNE K. HOY

and

JAMES E. HENDERSON

Rutgers University

Principal Authenticity, School Climate, and Pupil-Control Orientation

Hypotheses concerning the relationships among leader authenticity of the principal, openness of organizational climate, and humanism in pupil-control orientation were developed and tested. The Leader Authenticity Scale (LAS), subtests of the Organizational Climate Description Questionnaire (OCDQ), and the Pupil Control Ideology Form (PCI) were used to measure the variables in 42 elementary schools. All hypotheses were confirmed. Leader authenticity of principals was significantly related to openness in organizational climate and to humanism in pupil-control orientation of the school; and openness in climate was significantly related to humanism in pupil-control orientation. The results supported the assumption of the pivotal importance of leader authenticity in the development of the organizational climate of elementary schools.

In some schools behavior of teachers and principals is vibrant and complex; it seems real and genuine. In other schools, behavior is forced, shallow, and stereotyped; for the most part it is a hollow ritual in which individuals seem like actors on stage who have learned their parts by rote, but who perform without commitment (Halpin, 1966). Indeed, Halpin and Croft (1963) concluded their pioneering research of the organizational climate of schools with the observation that the chief consequence of their research was the identification of the pivotal importance of authenticity in organizational behavior. Little research has been

---

Professor Hoy is Associate Dean for Academic Affairs at Rutgers University, Graduate School of Education. His primary professional interests are theory and research in administration, and the sociology of organizations. Professor Hoy is coauthor with Cecil Miskel of *Educational Administration: Theory, Research, and Practice.*

Dr. James E. Henderson is the Assistant Superintendent of Upper Freehold Regional School District in Allentown, New Jersey. His major research interest is the social psychology of administration.

performed that directly addresses the authenticity of behavior of principals and teachers in schools; thus, the major purpose of this investigation was to develop and test a number of hypotheses relating the perceived authenticity of principals to the organizational climate and control orientations of schools.

Principal Authenticity

Leader authenticity is a fuzzy concept. People glibly talk about genuine, real, and authentic behavior, yet it is another matter to provide a clear and concise constitutive definition, let alone an operational one. Nonetheless, a comprehensive review of the literature revealed three major aspects of leader authenticity — accountability, manipulation, and salience of self over role (Henderson & Hoy; 1982). Leader authenticity thus was defined as the extent to which subordinates described their leader as accepting responsibility for actions, as being non-manipulating, and as demonstrating a salience of self over role. In contrast, the inauthentic leader was viewed as one who "passes the buck," blames others and circumstances for his/her errors, manipulates and uses subordinates, and is engulfed in the bureaucratic role requirements of the position.

A major problem that complicates any attempt to define the concept is the difference between (1) the authenticity of behavior as perceived by the participants in a given situation and (2) the authenticity of behavior as perceived by an external observer who attempts to evaluate this authenticity against an absolute standard (Halpin, p. 207). In this study authenticity of the leader's behavior was defined by teachers' perceptions of the principal's behavior in relative rather than absolute terms.

Organizational Climate

Organizational climate is an enduring quality of the internal environment of an organization as experienced by its members. The most well-known conceptualization of school climate is Halpin and Croft's (1963) description of the atmosphere of schools along a continuum of teacher-principal behaviors from open to closed. These contrasting types of climate are "ideal types," that is, pure analytic abstractions.

The open climate is an energetic, lively organization that is moving towards its goals while simultaneously providing satisfaction for the group members' social needs. Morale is high. Leadership acts emerge freely from either the teachers or the principal. The principal leads through example by providing the proper blend of structure and direction as well as support and consideration. Teachers do not overemphasize either task achievement or social needs satisfaction, but in both instances satisfaction seems to be obtained easily and almost effortlessly. The most striking feature of the open climate is the genuine behavior of both teachers and the principal.

At the other extreme, the closed climate is beset with a pervasive apathy among organizational members. The school seems stagnant because satisfaction is obtained from neither task achievement nor fulfillment of social needs. Teachers are disengaged; they simply go through the motions. Morale is low, and the principal is ineffective in attempts to move the organization by close supervision. Members play games with each other; their behavior is not genuine.

Pupil-Control Orientation

Another way to conceptualize the internal environment of the school is in terms of the control patterns employed by teachers and principals to direct students. The significance of pupil control in both the structural and normative aspects of the school culture has been well documented (Waller, 1932; Willower, Eidell & Hoy, 1967; and Hoy & Miskel, 1978); in fact, the dominant pupil-control orientations in schools have been used to distinguish between schools along a custodial-humanistic continuum. These contrasting terms refer to types of individual ideology and to the corresponding types of school organization that they seek to rationalize and justify.

The model for the custodial orientation is the traditional school, which provides a rigid and highly controlled setting concerned primarily with the maintenance of order. Students are stereotyped in terms of their appearance, behavior, and parents' social status. Teachers who hold a custodial orientation conceive of the school as an autocratic organization with a rigid pupil-teacher status hierarchy. The flow of power and communication is unilateral and downward; students must accept the decision of their teachers without question. Teachers do not attempt to understand student behavior, but instead view misbehavior as a personal affront. Students are perceived as irresponsible and undisciplined persons who must be controlled through punitive sanctions. Impersonality, cynicism, and watchful mistrust pervade the atmosphere of the custodial school.

The model for the humanistic orientation is the school conceived as an educational community in which students learn through cooperative interaction and experience. Learning and behavior are viewed in psychological and sociological terms, not moralistic ones. Self-discipline is substituted for strict teacher control. Humanistic orientations lead teachers to desire a democratic atmosphere with open channels of two-way communication between pupils and teachers and increased self-determination. In brief, a humanistic orientation is used in the sociopsychological sense suggested by Fromm (1948). It indicates an orientation that stresses the importance of the individuality of each student and the creation of an atmosphere to meet the wide range of student needs.

Rationale and Hypotheses

The major hypotheses guiding this study rest on the following two basic assumptions:

1. The principal is the single most important individual in setting the tone of relationships in an elementary school.
2. The perceived authenticity of the elementary principal's behavior has a pervasive influence on organizational climate.

Halpin (1966) uses the term, authenticity, to represent behavior which is "for real," that is, genuine or without pretense. He argues the distinguishing feature of elementary schools with an open climate is group authenticity. Behavior is not submerged by bureaucratic role demands. To the contrary, the open school climate provides enough flexibility in the specification of roles to permit individuals to be more themselves, that is, to adjust the role to their personal need-dispositions. Within the closed climate, however, the role itself and the individual's status as a teacher or a principal constitutes one's essential sense of identity. Furthermore,

the individual uses the role ritualistically, so that it becomes a device to keep others at a distance and to preclude the establishment of authentic relationships (Halpin, p. 205).

If the principal is perceived as one who accepts responsibility for his or her actions, does not manipulate subordinates, and demonstrates an importance of self over role, then teachers seem less likely to use their own professional role as a mask to hide their personal identity. In this instance, relationships among teachers and between teachers and the principal should be relatively open, genuine, and authentic. However, if the principal is viewed as one who "passes the buck," blames others for one's mistakes, manipulates subordinates, and hides behind the authority role, then relationships in the school organization will likely be guarded, phoney, and protective. Hence, it was hypothesized that:

> H_1 The greater the degree of perceived authenticity of the elementary school principal, the more open the organizational climate of the school.

Similarly, the perceived authenticity of the principal's behavior should be related to the pupil-control orientation of schools. Public schools are service organizations specifically vested with the cognitive and affective socialization of the young. However, they are a special type of service organization in which clients are unselected and participation is mandatory. Such organizations are frequently confronted with clients who have little motivation to take advantage of the services, and control of clients is a major organizational problem (Carlson, 1964). Public schools are no exception. The control of student-clients consistently has been found to be a significant feature of organizational life of schools; in fact, pupil control has been described as the "dominant motif" within the school social system and the integrative theme that gives meaning to patterns of teacher-teacher and teacher-principal relations (Waller, 1932; Willower & Jones, 1963; Willower, Eidell & Hoy, 1967; and Hoy, 1972).

If the principal promotes authentic behavior through example, it seems likely that such behavior will create a humanistic atmosphere in the school that stresses the importance of the individuality of each person — teachers and students alike. Rigid role definitions will fade. Students seem less likely to be stereotyped in terms of behavior and parents' social status. Self-discipline rather than punitive control, cooperation rather than isolation, and democratic rather than autocratic interactions seem likely consequences of authentic principal behavior. Hence, it was hypothesized that:

> H_2 The greater the degree of perceived authenticity of the elementary school principal, the more humanistic the pupil control orientation of the school.

If interactions among teachers and between teachers and the principal are authentic in the open school climate, then it seems reasonable that the authenticity would pervade teacher-pupil interactions Appleberry & Hoy, 1969). The humanistic pupil control orientation should facilitate and be facilitated by authentic teacher-pupil interactions.

The inauthenticity of the closed climate seems likely to increase teachers' fear of criticism, especially criticism concerning poor discipline or lack of control; hence, teachers will attempt to keep others at a distance and strive to maintain custodial control over students. The open climate, however, should provide a situation where teachers are more relaxed and less fearful of criticism from their colleagues, a climate that should foster more authentic pupil-teacher relationships and a more humanistic pupil-control orientation. Thus, it was hypothesized that:

H_3 The more open the organizational climate of an elementary school, the more humanistic the pupil-control orientation of the school.

Method

Operational Measures

Leader authenticity was measured by use of the Leader Authenticity Scale (LAS), a 32-item Likert scale on which respondents indicate the extent of their agreement. The LAS was developed in a comprehensive factor analytic study of the behavior of elementary principals. Items measuring accountability, non-manipulation of subordinates, and salience of self over role, as anticipated, loaded highly on a single bipolar authenticity factor, and construct validity for the scale was demonstrated (Henderson & Hoy, 1982). Examples of items included the following: "The principal is willing to admit mistakes when they are made"; "The principal manipulates the teachers"; and "The principal is a person first and an administrator second." Reliability for the LAS in the present sample was strongly supported with an alpha coefficient of .96.

Openness in the organization climate of a school was established with the Organizational Climate Description (OCDQ). The OCDQ is a 64-item Likert instrument composed of eight subtests. Respondents are asked to indicate the extent to which each statement characterizes their school from rarely occurs to very frequently occurs. Three of the subtests (Thrust, Esprit, and Disengagement) combine to form an index of the openness of the school climate (Halpin, 1966; Hoy, 1972a). Samples of items included the following: "The mannerisms of teachers at this school are annoying"; "Most of the teachers here accept the faults of their colleagues"; and "The principal sets an example by working hard himself." Reliabilities for the subtests in the present study ranged from .76 to .89. Construct validity of the openness index has been supported in a number of studies (Andrews, 1965; Hoy, 1972; Hartley & Hoy, 1972).

The pupil-control orientation of the school was measured by a 20-item instrument, the Pupil Control Ideology (PCI) form. Responses to each item are made on a Likert-type scale and are scored from strongly agree to strongly disagree; the higher the score the more custodial (less humanistic) the response. Examples of items included the following: "A few pupils are just young hoodlums and should be treated accordingly"; "It is often necessary to remind pupils that their status in schools differs from that of teachers"; and "Pupils can be trusted to work together without supervision" (score reversed). Validity of the scale has been consistently supported (Willower, Eidell & Hoy, 1967; Hoy, 1972). Reliability of the scale for the present sample was established with an alpha of .79.

Sample

Data were collected from 591 teachers in 42 elementary schools in New Jersey, 90% of the teachers in all schools. One half of the teachers were selected at random in each school and responded to the LAS; the other half responded to the OCDQ climate index and the PCI measure. The unit of analysis was the school, however, not the teachers; hence, data for each school were pooled and averaged to determine the degree of openness of school climate, the extent to which a school had a humanistic pupil-control orientation, and the authenticity of the behavior of the principal.

Results

The hypotheses were tested using correlational analysis and all three hypotheses were supported. The perceived authenticity of the principal was strongly related to the openness of the school climate; the more authentic the principal, the more open the organizational climate ($r=.63$, $p<.01$). Similarly, as predicted, the greater the degree of authenticity as described by teachers, the more humanistic (less custodial) the pupil control orientation of the school ($r=-.49$, $p<.01$). Finally, as hypothesized, the more open the organizational climate, the more humanistic the pupil-control orientation of the school ($r=-.44$, $p<.01$) (see Table 1).

TABLE 1

SUMMARY OF CORRELATIONAL DATA USED TO TEST THE HYPOTHESES

Hypothesis	N for Schools	r	p
1. Authenticity of Principal with Openness of School Climate	42	.63	.01
2. Authenticity of Principal with Pupil-control Orientation of School	42	-.49	.01
3. Openness of School Climate with Pupil-control Orientation of School	42	-.44	.01

Summary and Conclusions

The rationale for the hypotheses of this study stressed the significance of the principal's role in setting the tone of relationships in elementary schools. It was assumed that authentic principal behavior would pervade teacher-teacher as well as teacher-principal relationships producing a more open climate where individual behavior was not submerged by bureaucratic role demands; and teachers could be more themselves and adjust the role to their personality needs. We also theorized that if the principal promoted authentic behavior through example, that is, accepted responsibility for one's own actions, did not hide behind formal authority, and avoided manipulating others, then such behavior would foster a humanistic pupil-control atmosphere in the school, one that stressed the importance of the individuality of teachers and students alike. Self-discipline rather than punitive control, cooperation rather than isolation, and democratic rather than autocratic relations would be fostered by authentic principal behavior. The confirmation of the hypotheses that perceived leader authenticity of the principal was significantly related to the openness of the organizational climate and to the pupil-control orientation of the school supports this theoretical rationale.

Consistent with earlier research (Appleberry & Hoy, 1969), this research stressed the authenticity of interactions among professional personnel in schools with an open climate. It was postulated that if professional interactions were authentic, then authenticity would pervade teacher-pupil interactions and that a

humanistic pupil control orientation would facilitate and be facilitated by authentic interactions between teachers and pupils. The results support this explanation. Schools with open climate were significantly more humanistic in their pupil-control orientations.

Several studies (Coleman et al., 1966; Heath, 1970; Diebert & Hoy, 1972) have underscored both the atmosphere of the school and the students' sense of involvement and identification with school as salient factors in students' growth and development. That evidence, together with the results of the present research, suggests the potentially important role of principal authenticity in the development of healthy organizational dynamics; in fact, the success of any strategy for changing the climate of an elementary school seems limited unless the pivotal importance of the principal's leadership role is recognized. The findings imply that authenticity on the part of the leader seems to foster authenticity among teachers which in turn may pervade teacher-pupil relations.

Finally, the confirmation of the first two hypotheses provide additional support for the construct validity of the Leader Authenticity Scale (LAS), and thus provides organizational researchers with a useful measure of a theoretically significant concept.

References

Appleberry, J.B., & Hoy, W.K. The pupil control ideology of professional personnel in open and closed elementary schools. *Educational Administration Quarterly*, 1969, *5*, 74-85.

Andrews, J. School organizational climate: Some validity studies. *Canadian Education and Research Digest*, 1965, *5*, 317-333.

Carlson, R.O. Environmental constraints and organizational consequences; the public school and its clients. In D.E. Griffiths (Ed.), *Behavioral science and educational administration.* Chicago: University of Chicago Press, 1964.

Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfeld, F. D., and York, R.L. *Equality of educational opportunity.* Washington, D.C.: U.S. Government Printing Office, 1966.

Deibert, J.P., & Hoy, W.K. Custodial high schools and self-actualization of students. *Educational Research Quarterly*, 1977, *2*, 24-31.

Fromm, E. *Man for himself.* New York: Farrar and Rinehart, 1948.

Halpin, A.W. *Theory and research in administration.* New York: Macmillan, 1966.

Halpin, A.W., & Croft, D.B. *Organizational climate of schools.* Chicago: Midwest Administration Center, University of Chicago, 1963.

Hartley, M. and Hoy, W.K. Openness of school climate and alienation of high school students. *California Journal of Educational Research*, 1972, *23*, 17-24.

Heath, D.H. Student alienation and school. *The School Review*, 1970, *78*, 515-528.

Henderson, J.E., & Hoy, W.K. Leader authenticity: The development and test of an operational measure. New York, AERA paper, 1982.

Hoy, W.K. The influence of experience on the beginning teacher. *The School Review*, 1968, *76*, 312-323.

Hoy, W.K. Dimensions of student alienation and characteristics of public high schools. *Interchange*, 1972, *3*, 38-52. (a)

Hoy, W.K. Some further notes on the OCDQ. *The Journal of Educational Administration*, 1972, *10*, 46-51. (b)

Hoy, W.K., & Miskel, C.G. *Educational administration: Theory, research, and practice.* New York: Random House, 1978.

Waller, W. *The sociology of teaching.* New York: John Wiley and Sons, 1932.

Willower, D.J., & Jones, R.G. When pupil control becomes an institutional theme. *Phi Delta Kappan*, 1963, *45*, 107-109.

Willower, D.J., Eidell, T.L., & Hoy, W.K. *The school and pupil control ideology.* University Park: Pennsylvania State University, 1967.

The Alberta Journal of Educational Research *Volume XXIX, No. 2, June, 1983, 131-139*

D. R. GARRISON
Alberta Vocational Centre

Psychosocial Correlates of Dropout and Achievement in an Adult High School Completion Program

Little is known about the true relationship of nonschool variables and adult learner dropout. The purpose of this research was to determine the relative effects of socioeconomic and psychological factors upon dropout. In this study, the Differential Aptitude Test, the Tennessee Self Concept Scale, the Social Readjustment Rating Scale, the Adjective Check List, and a measure of perceived financial concern were administered to 92 adult high school completion students. Two sets of analyses were performed using persistence/dropout and achievement as dependent variables. The best significant predictor of dropout was found to be the Social Readjustment Rating Scale while the only significant predictor of achievement was the Differential Aptitude Test. The results were discussed regarding possible theoretical implications, variance explained, and limitations of the study.

When adults are asked why they dropped out of a formal learning setting, the typical reasons given are related to financial, social, and health problems. This is perhaps not surprising considering that some of the more apparent characteristics of adulthood are the roles and responsibilities assumed during the adult stages of life. However, these reasons are often seen as ego-sustaining rationalizations. Some researchers studying adult learner dropout downplay or reject outright such factors as valid reasons (Boshier, 1972; Miller, 1970; Zahn, 1964). Unfortunately, due primarily to methodological deficiencies, the true influence of socioeconomic factors upon dropout has yet to be adequately assessed.

The most serious of these deficiencies is that dropout studies have usually been conducted after attrition has occurred. This has left the findings open to the

---

Dr. Garrison (EdD, University of British Columbia, 1983) is an instructor and administrator in adult education at the Alberta Vocational Centre in Calgary, Alberta. During his doctoral studies, he was awarded an SSHRC fellowship. His areas of interest are in adult dropout, and the use of computers in adult education.

charge that most nonschool reasons for dropout are rationalizations and that such factors are relatively minor irritants that simply trigger dropout. A second deficiency of much research into dropout concerns the study of one or two variables, or at best, a cluster of highly correlated variables. In this way the predictive power of a variety of variables cannot be determined.

The importance of a particular variable on dropout can only be properly determined in relation to other variables. The complex interrelationships of the many variables involved necessitates a perspective that views the adult learner in a more holistic manner such that the effect of variables relative to, and in combination with other variables, may be determined. In particular, the prediction and control of dropout in adult education remains at an embryonic stage because of the complexity of adult learner behavior, the fragmented approach to studying the problem, and the overdependence upon univariate designs.

The main purpose of this study was to determine which of a set of psychosocial variables significantly discriminated between persisters and dropouts in an adult high school completion program. An additional purpose was to determine which of the same set of independent variables best predicted achievement for the persisters.

Design

Instrumentation

The instruments used were the Differential Aptitude Tests: Verbal Reasoning (Bennett et al., 1972), Tennessee Self Concept Scale (Fitts, 1965), Social Readjustment Rating Scale (Holmes & Rahe, 1967), Adjective Check List (Gough & Heilbrun, 1980), and a subjective rating scale of perceived financial concern. The Differential Aptitude Tests: Verbal Reasoning (DAT) purports to measure how well an individual can understand, think, and reason verbally. Several dimensions of self-concept derived from both internal and external frames of reference were measured by the Tennessee Self Concept Scale (TSCS). The Adjective Check List (ACL) measures the expressed needs of the individual and the individual's personality and social dispositions. An instrument consisting of Likert-type scales was used to elicit responses regarding financial concern.

The independent variables were selected from the scales and subscales of the above instruments. Inclusion of all the subscales was impossible because of limitations due to sample size. The rationale for selection was based primarily upon previous research findings. The three major subscales of the TSCS were used in the analysis. They were identity, self-satisfaction, and behavior. In addition, achievement need, endurance, and self-control were three variables selected from the ACL. A description of the nine variables used in the analysis follows:

1. DAT: the DAT purports to measure how well an individual can understand, think, and reason verbally, as well as being a good predictor of educational performance.
2. SRRS: the SRRS is a measure of recently experienced life changes that results in stress. Examples of such changes are a family death, financial commitment, and job change.
3. Financial Concern: this instrument assesses the perceived degree of financial concern.
4. Identity: a subscale of the TSCS which reflects how an individual sees himself regarding his basic identity.

5. Self-satisfaction: this TSCS subscale measures the level of perceived acceptance.
6. Behavior: this TSCS subscale measures individuals' perceptions of how they act.
7. Achievement Need: a subscale of the ACL which assesses the need to strive and live up to socially recognized performance.
8. Endurance: the persistence in a task undertaken is measured by this ACL subscale.
9. Self-control: this variable is also an ACL subscale where the high scorer can be typified as being responsible and diligent while the low scorer is self-centered and expressive.

Reliability and Validity

Split-half reliability coefficients of the DAT: Verbal range from .90 to .95. Validity correlation coefficients show the DAT: Verbal to be a very good predictor of educational performance. Test-retest reliability coefficients for the major subscales of the TSCS are all over .90. Construct validity was determined through unanimous agreement by judges that items were classified correctly. The test has also been validated using discrimination among groups, correlation with other personality measures, and personality changes under particular conditions. The ACL median alpha reliability coefficients for males was .76 and .75 for females. The construct validity of this test was based upon correlations with external or nontest criteria as well as inferred psychological meaning. The financial concern questionnaire was pilot tested and eight items were retained having a Hoyt's reliability estimate of .95. Content validity, assessed by judges, was determined to be high.

Sample and Administration

Ninety-two adult learners enrolled in tenth grade English and math courses comprised the sample. These courses were part of a high school completion program designed for students who were either 18 years of age or older or who had been out of school at least one full year.

The instruments were administered during the third class of the spring semester, 1981. The five instruments took approximately 1½ hours to administer and were given in the following order: SRRS, financial concern, ACL, TSCS, and the DAT.

Analysis

The dependent variables of the two sets of analyses were persistence/dropout and achievement. Dropouts were those students who did not receive a grade at the end of the course and were classified as incomplete. Achievement was measured by means of six letter grade categories used by the institution and was considered to be a continuous variable since gradations of achievement were apparent. Within class standardized scores were used in all analyses in order to eliminate between class variance differences.

The ability of the nine independent variables to discriminate between persisters and dropouts was tested using the Statistical Package for the Social

Sciences (Nie et al., 1975) discriminant analysis program. This program uses a stepwise solution which selects variables on the basis of their discriminatory power.

Multiple regression analysis was used to determine whether the nine independent variables could significantly predict achievement for the persister. This was tested using the Statistical Package for the Social Sciences (Nie et al, 1975) multiple regression program. The program employs a stepwise solution which selects variables based upon an inclusion significance criteria.

TABLE 1

MEANS AND STANDARD DEVIATIONS
OF PREDICTOR VARIABLES FOR CRITERION GROUPS

Predictor Variable	Persister (58)	Dropout (34)
1. DAT		
Mean	- .0937	.1599
Std. Dev.	1.0169	.8822
2. SRRS		
Mean	- .2150	.3667
Std. Dev.	.8407	1.0796
3. Financial Concern		
Mean	- .0592	.1010
Std. Dev.	.9466	1.0206
4. Identity		
Mean	.1152	- .1966
Std. Dev.	.8443	1.1453
5. Self-Satisfaction		
Mean	.0663	- .1132
Std. Dev.	.9084	1.0769
6. Behaviour		
Mean	.0050	- .0085
Std. Dev.	.9681	.9936
7. Achievement Need		
Mean	- .0144	.0245
Std. Dev.	.9115	1.0817
8. Endurance		
Mean	.1091	- .1861
Std. Dev.	.8669	1.1186
9. Self-Study		
Mean	.1959	- .3343
Std. Dev.	.9645	.9037

Note: Group size is shown in brackets

Results

Persistence/Dropout

The focus of this analysis was upon the ability of the nine independent variables to discriminate between persisters and dropouts. Predictor variable

means and standard deviations are reported separately in Table 1 for the persister and dropout groups. The intercorrelation matrix for the nine predictor variables is shown in Table 2. Two discriminant analyses were performed. The first analysis allowed all the variables to enter, which yielded an assessment of the relative contribution of each variable to the discrimination of persisters and dropouts. In the second analysis, only those variables which contributed significantly ($p<.05$) to the discrimination were retained. Thus a more parsimonious solution was obtained.

TABLE 2

INTERCORRELATIONS OF THE PREDICTOR VARIABLES

	DAT	SRRS	Financial Concern	Identity	Self-Satisfaction	Behavior	Achievement Need	Endurance	Self-Control
DAT	1.00								
SRRS	.11	1.00							
Financial Concern	-.17	.19	1.00						
Identity	.19	-.07	-.21	1.00					
Self-Satisfaction	.08	-.10	-.21	.62	1.00				
Behavior	.01	.09	-.07	.72	.62	1.00			
Achievement Need	.04	-.07	-.04	.43	.48	.37	1.00		
Endurance	.02	-.14	-.02	.37	.51	.52	.71	1.00	
Self-Control	.00	.07	.11	.07	-.05	.19	-.16	.24	1.00

The results of the first analysis allowing all variables to enter are given in Table 3. The independent variables are listed in order of their discriminating power along with the corresponding value of Wilks' lambda and significance level for each step. The two most powerful discriminators were the SRRS (life changes) and self-control. The remaining variables did not significantly increase discrimination as indicated by the significance levels. The persistence/dropout variance explained by all the variables was 20.9 percent.

When the significance criterion ($p<.05$) for additional discriminatory power was applied, only the SRRS and self-control variables were retained. The summary of the second analysis can be found in Table 4. It is interesting to note here that 15.2 percent of the variance was explained by these two variables.

By using the discriminant function to predict group membership for those students used to derive the function, an additional discrimination assessment was made. Classification results for both analyses are reported in Table 5. Results indicated that 63 percent of the subjects were classified correctly when all variables were included in the discriminant function and increased to 68.5 percent for the second analysis. Prior probabilities for classification purposes were set at .5.

TABLE 3

ORDER OF ENTRY OF INDEPENDENT VARIABLES
(ANALYSIS ONE: NO CRITERION)

Step	Independent Variable	Wilks' Lambda	Significance
1	SRRS	.9157	.0050
2	Self-Control	.8474	.0006
3	Identity	.8379	.0013
4	Behavior	.8220	.0017
5	DAT	.8066	.0021
6	Endurance	.8035	.0041
7	Achievement Need	.7927	.0054
8	Self-Satisfaction	.7913	.0099
9	Financial Concern	.7907	.0176

TABLE 4

SUMMARY STATISTICS: DISCRIMINANT ANALYSIS
(ANALYSIS TWO: SIGNIFICANCE CRITERION)

Independent Variable	Standardized Discriminant Function Coefficients
SRRS	.7646
Self-Control	-.7007
Eigenvalue	.1801
Canonical Correlation	.3907
Significance	.0006

Achievement

The second purpose of this study concerned the ability of the nine independent variables to predict persister achievement levels. As was done previously, two analyses were performed. The first multiple regression analysis allowed all the variables to enter giving an assessment of the relative contribution of each of the variables. This was followed by a stepwise multiple regression with the criterion that only those variables which contributed significantly ($p<.05$) to the prediction of achievement were retained.

Having allowed all the independent variables to enter the regression equation yielded the results found in Table 6. The variables are listed in order of their additional contribution to the prediction of achievement. The best predictor was the DAT. The second analysis using the significance criterion for additional predictive power allowed only the DAT to be included. The achievement variance explained by all the variables was 26.8 percent while the DAT by itself accounted for 7.5 percent of the variance.

TABLE 5

CLASSIFICATION RESULTS FOR PERSISTERS/DROPOUTS

	Actual Group Membership	Number of Subjects	Predicted Group Membership	
			Persisters	Dropouts
First Analysis: No Criterion				
	Persister	58	67.2% (39)	32.8% (19)
	Dropout	34	44.1% (15)	55.9% (19)
Percent classified correctly: 63%				
Second Analysis: Significance Criterion				
	Persister	58	69.0% (40)	31.0% (18)
	Dropout	34	32.4% (11)	67.6% (23)
Percent classified correctly: 69%				

Note: Number of subjects are in brackets.

TABLE 6

REGRESSION ANALYSIS SUMMARY

Step	Independent Variable	Squared Multiple Correlation	*F* Ratio	*F* Prob.
1	DAT	.0748	4.53	.038
2	Endurance	.1225	3.84	.028
3	Financial Concern	.1630	3.51	.021
4	SRRS	.2101	3.52	.013
5	Self-Satisfaction	.2438	3.35	.011
6	Achievement Need	.2667	3.09	.012
7	Self-Control	.2673	2.61	.023
8	Behavior	.2675	2.24	.040
9	Identity	.2680	1.95	.067

Discussion

The findings of the discriminant analysis have shown that of the variables considered, life change (SRRS) was the best predictor of dropout. The other significant predictor was found to be self-control which was characterized (on the positive pole) as representing responsibility, diligence, and patience. The results of the multiple regression analysis in predicting persister achievement indicated that the DAT was the only significant predictor.

Considering the dependent variable persistence/dropout, the important finding was that dropout appears to be strongly influenced by environmental factors. This

is reflected in the fact that life change is a significantly better predictor of dropout than self-concept measures or cognitive aptitude, as previous research (Boshier, 1972; Zahn, 1964) has suggested. The implication of this finding is that perhaps when adult learners say they dropped out for family, health, or economic reasons they may not be simply invoking ego-sustaining rationalizations.

The results of the analysis of both dependent variables for this sample of students indicated that persistence/dropout and achievement are two relatively distinct phenomena. In fact, it appeared that dropout is influenced more by environmental concerns while achievement is related to cognitive ability. If these results are valid, there exists a close parallel to Herzberg's (1967) theory of motivation in the work setting. Herzberg states that factors which contribute to job satisfaction are distinct from those which contribute to job dissatisfaction. He suggested that dissatisfiers include environmental variables which are either neutral or impediments to doing a task, whereas satisfiers are those variables which relate to the performance of a task. If dropout was to be considered a reflection of dissatisfaction and achievement was associated with satisfaction, then the results of this study correspond very well to Herzberg's theory when applied to the adult learning setting. It may be that a similar theory could be useful in understanding adult dropout and achievement.

Another point of discussion concerns the persistence/dropout variance explained by the predictor variables. It should be emphasized that, although a relatively small amount of variance was explained, this was not inconsistent with previous research (Anderson & Darkenwald, 1979; Knox & Sjogren, 1965). Perhaps one explanation for this is that a large number of variables may combine in unique ways to cause dropout. Not only may the critical combination of variables be unique to each individual but they are certain to change over time. This necessitates a much broader perspective of the adult learner. Factors outside the context of the formal learning setting must be seriously considered if the understanding and prediction of adult dropout is to be improved. In addition the effect over time of both school and nonschool factors must be studied.

The results of this study have revealed several significant relationships; however, because of the selection and size of this sample, extreme caution must be exercised in attempting to generalize these findings. It is therefore necessary that replication studies within other institutions and across various educational levels be conducted. Financial support for the project was provided through a grant from the Educational Research Institute of British Columbia.

Financial support for the project was provided through a grant from the Educational Research Institute of British Columbia.

References

Anderson, R., & Darkenwald, G. *Participation and persistence in American adult education.* New York: College Entrance Examination Board, 1979.

Bennett, G., et al. *Differential Aptitude Tests: Verbal Reasoning (Form T).* New York: The Psychological Corporation, 1972.

Boshier, R. The development and use of a dropout prediction scale. *Adult Education*, 1972, 22(2), 87-89.

Fitts, W. *Tennessee Self Concept Scale.* Nashville: Counselor Recordings and Tests, 1965.

Gough, H., & Heilbrun, A. *The Adjective Check List.* Palo Alto: Consulting Psychologists Press, 1980.

Herzberg, F. *The motivation to work.* New York: John Wiley & Sons, Inc., 1967.

Holmes, T., & Rahe, R. The Social Readjustment Rating Scale. *Journal of Psychosomatic Research*, 1967, *11*, 213-218.

Knox, A., & Sjogren, D. Achievement and withdrawal in university adult education classes. *Adult Education*, 1965, *15*(Winter), 74-88.

Miller, G. *Success, failure, and wastage in higher education.* London: George G. Harrap & Co. Ltd., 1970.

Nie, N., et al. *Statistical package for the social sciences, (2nd ed.).* New York: McGraw-Hill, 1975.

Zahn, J. Dropout and academic ability in university extension courses. *Adult Education*, 1964, *15(1)*, 35-46.

The Alberta Journal of Educational Research *Volume XXIX, No. 2, June, 1983, 140-152*

JAMES M. SHERRILL
The University of British Columbia

Solving Textbook Mathematical Word Problems

The results of the last two British Columbia Mathematics Assessments demonstrated that a drastic differential in performance existed among elementary school students with respect to solving multi-step mathematical word problems as opposed to one-step problems.

Two groups of nine students were formed such that every student had a perfect score on one-step problems and yet one group's score on multi-step problems was over twice as great as the other group. The subjects were interviewed in a situation where they solved problems from elementary school mathematics materials. Some of the results from the protocol analysis were that the students tended to "skim" for facts rather than re-read the problems which led to 40% of the multi-step problems being treated as one-step problems, that students did not check either their work or their final answer, and that either the students were inexperienced with heuristics (other than Uses Algorithms) or elementary textbook story problems do not require the use of other heuristics for solution.

This article concerns grade 7 students solving grade 7 level word problems from grade 7 level materials. The problems are not unusual and the problems are routine.

If one defines "problem solving" in the classical sense that there are three conditions:

1. The individual has a clearly defined goal of which he is consciously aware and whose attainment he desires.

Dr. James M. Sherrill is a Professor in the Department of Mathematics and Science Education at the University of British Columbia. He served on the Contract Team of the 1977 and 1981 B.C. Mathematics Assessments and the Technical Sub-Committee for B.C.'s participation in The Second International Mathematics Study. He is currently serving as the Associate Director of the Graduate Programme's Office at U.B.C. and as Chairman of the Board of Directors of the Educational Research Institute of B.C.

2. Blocking of the path toward the goal occurs, and the individual's fixed patterns of behavior or habitual responses are not sufficient for removing the block.
3. Deliberation takes place. The individual becomes aware of the problem, defines it more or less clearly, identifies various possible hypotheses (solutions), and tests these for feasibility. (Henderson & Pingry, 1953, p. 230)

then this is an article on problem solving. When one looks at the results one realizes "blocking" should have occurred but did not.

The current study was designed to look at problem solving as it relates to solving certain types of word problems found in elementary school mathematics materials. Mathematics teachers at every level are depending on textbooks and their most frequent use of their textbook is as a source of problems, according to the results of the 1977 B.C. Mathematics Assessment (Robitaille & Sherrill, 1977b, pp. 42, 44, 45). The decision to look at textbook word problems was originally based upon the results of the 1977 B.C. Mathematics Assessment. The results of the most recent B.C. Mathematics Assessment (1981) supported the decision.

One of the disturbing results of both the 1977 and the 1981 B.C. Mathematics Assessments was the differential performance of students on one-step and multi-step mathematical word problems.

A one-step mathematical word problem is a problem that can be solved by combining the given numbers using one operation. A multi-step mathematical word problem is, of course, a problem requiring more than one step for solution. There are, however, many types of multi-step mathematical word problems.

Two types of multi-step problems were used in the study. The first type was word problems where one must combine the given numbers, but using more than one operation. The other type was word problems where one must generate from the given numbers another number which is required for the solution.

On the B.C. Mathematics Assessment test given to the Grade 8 students (grades K - 7 are in the elementary schools in B.C.) in 1977 there were three items the author categorized as one-step problems and six items categorized as multi-step problems. The average performance on the one-step problems was 73.3%; the average performance on the multi-step problems was 44.8% — a differential in performance of 28.5%!

On the B.C. Mathematics Assessment tests given to Grade 8 students in 1981 there were 10 items of each type of problem. The differential in performance was 25.9%.

From the results of the B.C. Mathematics Assessment it appeared that there existed a sizable group of elementary school students who were good at solving one-step mathematical word problems while at the same time poor at solving multi-step mathematical word problems. The present study is an investigation of that phenomenon.

To achieve the purposes of the study two groups of students were interviewed in a problem-solving situation. Protocols were created from the interviews, analyzed, and compared.

Method

Subjects

The grade level selected for the study was Grade 7 since it represents the final year of the elementary mathematics curriculum in B.C. and, therefore, the most

mature elementary students with the greatest proficiency with the four basic operations.

Since the "think aloud" interview technique was to be used with the final sample of students, it was necessary that the size of the sample be kept small. However, the process of identifying the type of student needed for the interview required testing many students. The criteria each student had to pass to remain for possible selection for the interview groups are shown in Figure 1.

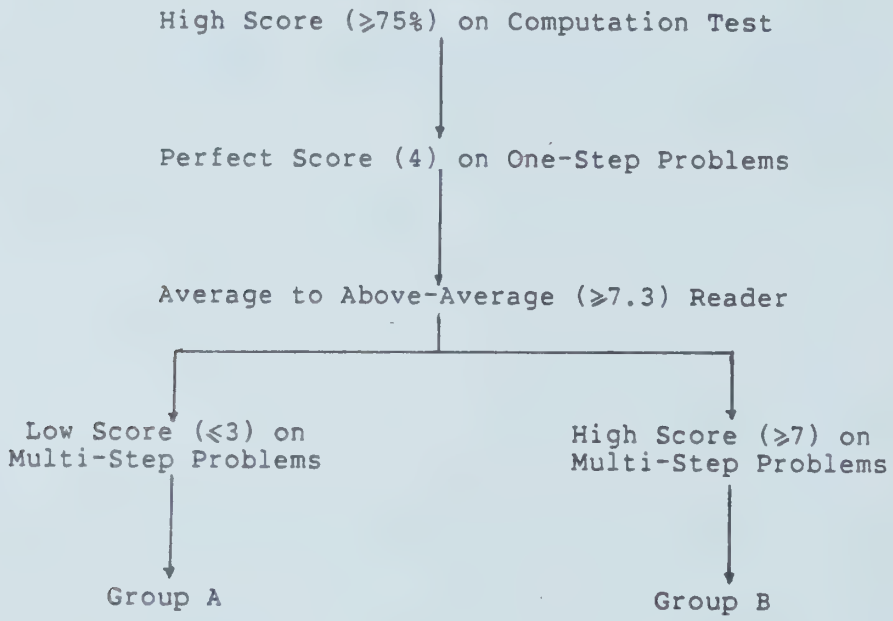

High Score (≥75%) on Computation Test
Perfect Score (4) on One-Step Problems
Average to Above-Average (≥7.3) Reader
Low Score (≤3) on Multi-Step Problems
High Score (≥7) on Multi-Step Problems
Group A
Group B

Figure 1. Criteria for group membership.

The original sample consisted of all 283 grade seven students in the seven elementary schools involved in the study. The interview sample consisted of two groups of 9 subjects each. The method for going from 283 students to 18 students is presented in the Procedure section.

Instruments

Two problem-solving tests and a computation test were developed. The initial problem-solving test consisted of 12 items (a one-step problem, and two multi-step problems for each of four different physical settings). The second problem-solving test contained 9 problems, a one-step problem and two multi-step problems for each of three different physical settings. A 42-item computation test was created based on the computation required to solve the word problems.

Over 600 word problems were collected from grade 7 materials. All items were screened on three criteria:

1. From the original item both a one-step and the multi-step problems could be created.
2. All three forms of the item could be worded in the same physical setting.
3. All three forms of the item were appropriate for the grade 7 level.

Looking at the criteria listed above it should be noted that there was no attempt to search out novel problems or problems that facilitate the use of specific heuristics. For many problem-solving studies the lack of such criteria

would be a weakness. For the present study, however, the problems were to be ones found in regular grade 7 materials.

One hundred and twenty items were field-tested and 36 (three forms of each of twelve word problems) were selected. The descriptive statistics for the computation test and the problem-solving test used in the selection of subjects are presented in Table 1.

TABLE 1

DESCRIPTIVE STATISTICS FOR THE TESTING INSTRUMENTS

Instruments	Number Of Items	Mean	Standard Deviation	Reliability
Computation Test	42	32.1	5.7	0.85
Problem-Solving Test	12	7.1	2.7	0.71
One-Step Problems	4	3.1		
Multi-Step Problems	8	4.0		

Procedure

The first part of the study was to create the interview groups. The data in Table 2 describe the order in which the criteria were applied and the successive elimination of subjects.

TABLE 2

CRITERIA USED TO CREATE THE INTERVIEW GROUPS

Criteria	Number of Subjects Eliminated	Number of Subjects Remaining
Original Sample	---	283
Complete Data	18	265
Perfect Score on One-Step Problems	149	116
Score of 30 or More on Computation Test	41	75
Reading level $\geq$ 7.3	21	54
Scores of 0-3 or 7-8 on Multi-Step Problems	25	29

Based on discussions with colleagues involved in interview research it was decided that 15-20 interviews were all that could be analyzed in the time period allowed. Two groups of nine students each were created from the 29 students that remained.

The sole basis for selection of the final 18 subjects from the remaining 29 was each subject's score on the multi-step problems. The subjects with the 9 lowest scores became group A and the subjects with the 9 highest scores became group B. As one can see from Table 3, however, *both* groups averaged 35 (83%) on the computation test, *both* groups have high reading levels (over one grade level above average), *every* member of both interview groups scored perfect on the one-step

problems (which was required), and yet, one group scored over twice as high as the other group on the multi-step mathematical word problems.

TABLE 3

CRITERIA SCORES FOR THE TWO INTERVIEW GROUPS

	Computation Test	Reading Level	One-Step Problems	Multi-Step Problems
Group A	35.0	8.7	4.0	3.0
Group B	35.0	8.7	4.0	7.1

The second part of the study was the interview. The interviews were scheduled by the school in consultation with each student interviewed, each student's teacher, and the interviewer. The interviewer was the same person who created the protocols. Neither the interviewer nor the author, who analyzed the data, knew to which group any subject belonged. Grouping the data and the analysis of the protocols by Group A and Group B was one of the final steps of the study.

The interview included the subject solving six problems (one of each type of problem for each of two physical settings). The interviews made use of the "think aloud" procedure. The procedure has been used in similar research studies most notably by Krutetskii (1976), Menchinskaya (1969), Kantowski (1974), Blake (1976), and Kilpatrick (1967). Since the "think aloud" procedure was used, the interviewer had several warm-up problems available to use with the students to get them to think aloud.

The protocols consisted of a typed transcript of the entire interview.

The problems (See List of Problems) were presented one at a time. Based on the results of a pilot study, it was decided that each subject would be presented with only 6 of the 9 problems. The problems were arranged in cycles so that each subject faced 6 problems. In each cycle a one-step problem appeared first, then two of the first type of multi-step problems followed by the other one-step problem then two of the other type of multi-step problems.

Results

The problems were labeled ABC-DEF-GHI, where each triple represents one physical setting. The first problem in each triple is the one-step problem.

The success of the students on each item is presented in Table 4.

Given that the problems were of the type found in Grade 7 materials, it is not surprising that the success rate is higher than in many problem-solving studies in which novel and unusual problems are used. Given how Groups A and B were constructed it is also not surprising that Group B outperformed Group A. When the items are subdivided into one-step vs. multi-step problems, the definition of the two groups is upheld. On one-step problems Group B outperformed Group A by a very slight margin (18 to 16) while on the multi-step problems Group B had a very large advantage (31 to 21).

Overall, the subjects presented correct solutions to 34 of 36 instances of one-step problems and 52 of 72 instances of multi-step problems.

TABLE 4

STUDENT SUCCESS ON THE INTERVIEW PROBLEMS

	PROBLEM									Total
Group A	A	B	C	D	E	F	G	H	I	
1	1*	1	1	1	1	1	-	-	-	6
2	1	1	1	1	1	1	-	-	-	6
3	1	0	0	1	1	0	-	-	-	3
4	1	0	0	-	-	-	1	1	0	3
5	1	0	0	-	-	-	0	0	1	2
6	0	0	0	-	-	-	1	1	0	2
7	-	-	-	1	1	1	1	1	0	5
8	-	-	-	1	1	1	1	1	0	5
9	-	-	-	1	1	0	1	1	1	5
Total	5	2	2	6	6	4	5	5	2	37
Group B										
1	1	1	1	1	1	1	-	-	-	6
2	1	1	1	1	1	1	-	-	-	6
3	1	1	1	1	1	1	-	-	-	6
4	1	1	1	-	-	-	1	1	0	5
5	1	0	1	-	-	-	1	1	1	5
6	1	1	1	-	-	-	1	1	0	5
7	-	-	-	1	1	1	1	1	1	6
8	-	-	-	1	1	0	1	1	1	5
9	-	-	-	1	1	1	1	1	0	5
Total	6	5	6	6	6	5	6	6	3	49

* 1 means the student solved the problem; 0 means the student did not solve the problem; - means the problem was not in the student's interview.

The data in Table 5 describe the amount of time spent in solving the word problems.

TABLE 5

AVERAGE TIME SPENT ON EACH PROBLEM
BY GROUP (IN SECONDS)

	PROBLEM								
Group	A	B	C	D	E	F	G	H	I
A	137	133	153	53*	88	120*	112	124	216*
B	68*	71*	99*	57	69	95	65	131*	123

* Computed after eliminating outlying times. Outlying times had to exceed the next greatest time by 200 seconds or more.

As explained in the footnote with Table 5, four problems in Group B and 3 problems in Group A had outlying times. An outlying time was defined to be a time that exceeded the next greatest time by 200 seconds. The outlying times were caused by the student either trying repeatedly to use an incorrect arithmetic

algorithm or trying to get a solution based on a prior problem of the same physical setting. The first reason offered no discernible insights into the solution process and the second reason is discussed later. In five of the seven cases there was only one item that required more time than 200 seconds and it was 200 seconds above the next greatest time. Interestingly enough, six of the seven students with outlying times solved the problem! On the one problem that had an outlying time and was not solved, the student spent almost half an hour (1694 seconds) searching for a solution. Since such extreme times do give an inflated mean (and the median would yield little information when dealing with time), the outlying times were eliminated *before* computing the average time spent on a problem.

It is also interesting that only one student missed Problem A and only one person missed Problem G, yet it took Group A almost twice as long to solve the two problems as Group B.

The descriptive statistics given thus far should be ample reminder that this study deals with solving word problems that grade 7 students normally confront, not novel or unusual problems.

The following results deal with the procedures the subjects used for solving the type of word problems they find in their textbooks.

Reading the Problem

Students were required to read the problem to begin their work. The data in Table 6 represent the number of times each problem was *re-read* by the two groups. Each problem was read by six students.

TABLE 6

NUMBER OF TIMES EACH PROBLEM WAS REREAD

	P R O B L E M								
Group	A	B	C	D	E	F	G	H	I
A	2	6	12	3	2	4	4	6	8
B	3	2	5	2	0	1	1	6	0

The three most difficult items (I, B, and C) were three of the four most re-read items. The problem re-read second most often was Problem H, which only one person failed to solve. Half of the Group B students who worked on Problem I missed it, but no one re-read the problem. The most commonly re-read problem (Problem C) yielded a median of only 1.17 re-readings.

Number of Re-attempts

The number of times a student attempted each problem was tallied. Since each student attempted each problem at least once, the date in Table 7 represent the number of re-attempts, defined to be situations where a student starts working on a problem again from a beginning step.

TABLE 7

NUMBER OF REATTEMPTS BY GROUP

	P	R	O	B	L	E	M		
Group	A	B	C	D	E	F	G	H	I
A	5*	3	2*	0	0	0	0	0	0
B	2	4	2	3*	1	1	2*	0	7

*All re-attempts by the same student.

Of the 17 problems missed by Group A students, only 7 were attempted more than once. Of the 5 problems missed by Group B students, *none* were attempted more than once.

Since the author would rather run the risk of being accused of going beyond the data than avoiding using the quality of the data to make a statement, a conclusion will be reported here. In almost all cases where a student reported an incorrect result but did not re-attempt the problem, the cause seemed to be that he felt his technique was correct therefore his result was correct. This was true even when it was obvious he had little faith in the correctness of his result.

Arithmetic

The two groups averaged 83% on the test covering the arithmetic involved in solving the word problems. However, it is still quite surprising that of the 22 problems missed, only 3 solutions involved computational errors. A much greater problem was not knowing the numbers and/or operations with which to apply their computational skill.

Checking Answers

After obtaining an answer for a problem, conventional wisdom says students should be encouraged to check their answers. Each group faced 54 problems (6 problems x 9 students). Of the 54 problems faced by Group A students, 2 were checked; of the 54 problems faced by Group B students, 9 were checked. All 11 problems for which solutions were checked were eventually solved correctly.

Heuristics

The largest segment of the current research in mathematical problem solving deals with the use of heuristics. The protocols were analyzed for occurrences of the eight most commonly observed heuristics (based on a survey of the research literature by I. Isaacs of the University of the West Indies and verbally communicated to the author in a faculty seminar). The eight heuristics are as follows:

Draws Diagrams
Trial and Error
Recalls Related Facts
Recalls Related Method
Uses Mnemonics and Equations
Uses Algorithms
Examines Special Cases
Successive Approximations.

Draws Diagrams: The types of problems involved in the interviews were not types that would generate diagrams so it isn't surprising that no diagrams were drawn. Three students did, however, represent the problem in a visual form by arranging the data in a table.

All three tables were constructed for the data in Problem H. All three students were successful in attaining the correct solution, but only one person interviewed was not successful on Problem H.

Trial and Error. One characteristic usually attributed to good problem solvers is the tendency to use numeric examples to try to gain some understanding of the structure of the problem situation.

Not a single instance of trial and error was observed in the interviews. Again, one could argue the problem types eliminated this heuristic as a viable approach. In the adult view of the problems, however, the opportunity for using trial and error existed.

Recalls Related Facts. There were five instances where the problem solution was developing slowly until the student remembered a specific fact that was related to the problem situation. In all five cases the student was trying to solve the second type of multi-step problem. In four of the five cases the student recalled a specific number that was required (but not given) for the solution.

Recalls Related Method. Although the students were forewarned and reminded of the warning that no two problems were the same, the students were very concerned about problems having the same physical setting. Each student faced six problems, 3 each of 2 different physical settings. Some students tried to recall how they solved the last one of the same setting.

There were 3 problems for each physical setting used. All 3 problems used very similar wordings (see List of Problems). For problems A, B, and C, for example, there were 26 instances of students actually saying something like "I'm trying to remember how I solved the last contractor problem."

Uses Mnemonics and Equations. There was only one attempt to try to introduce symbolism into the solution. It should be added that few textbook problems require such an approach except for problems that are in the book for that very purpose.

Uses Algorithms. This is where the emphasis is undoubtedly being placed in problem-solving strategies in the public elementary schools. By far the most common approach was to read the problem for the key word(s) (word[s] that directs one to the proper operation), select the algorithm based on the key word, apply the algorithm.

The use of this heuristic was unanimous. The technique has strengths and weaknesses. Three strengths certainly are that it is easy to teach, easy to apply, and very successful with one-step problems. The weaknesses that appeared in the current data are presented at the beginning of the Discussion section.

Examines Special Cases: No one used this heuristic.

Successive Approximations. No one used this heuristic.

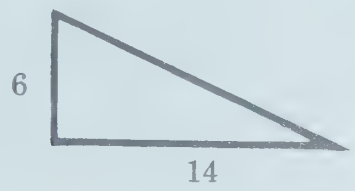
Of the eight most commonly observed heuristics in previous research studies only one was observed to any great extent and that was Uses Algorithms. Again, any set of problems will have characteristics that obviate the use of certain heuristics. It may not be that the subjects involved in the study do not have all

eight heuristics in their repertoire; it may be that the problems found in current elementary school mathematics materials do not require such heuristics for solution.

One-Step - vs - Multi-Step Problems .

The problem below is from the 1981 B.C. Mathematics Assessment.

40. Find the area of this right triangle.



	% Correct
42	27
20	20
84	36
21	4
I don't know	14

While only 27% of the students solved the problem correctly, 56% of the students treated the item as a one-step problem. Thirty-six percent of the students multiplied the two given numbers and stopped; another 20% of the students added the two given numbers and stopped. Had this had been a problem of finding the area of a rectangle the 36% selecting 84 would have been counted as correct, but, perhaps, for the wrong reasons.

Of the ten multi-step problems on the 1981 B.C. Mathematics Assessment instrument, incorrect responses on six of the items appear to have been the direct result of students treating the problems as one-step problems. On four of the six problems more students selected the one-step answer than selected the correct answer. Of the 20 Incorrect solutions to the multi-step problems involved in the interviews, 8 were a result of treating a multi-step problem as a one-step problem.

Discussion

As with other studies of the present type the richness of the data provides more results and trends than can be presented in one article. The full report is listed in the references. In this section only four results will be discussed.

A. As mentioned toward the end of the last section, the students demonstrated one pervasive problem-solving strategy;

1. Search for key words.
2. Select the algorithm based on the key words.
3. Apply the algorithm.

The use of such an approach was unanimous. The technique has strengths and weaknesses. The strengths were discussed earlier; based on the data from the present study the weaknesses are:

1. The student can identify key words, but select either the wrong algorithm or the wrong *sequence* of algorithms (7 instances).
2. The student can identify key words, select the proper algorithm, but use the wrong numbers (9 instances).
3. The student can identify key words, select the proper algorithm, apply the algorithm properly, and stop, not realizing the problem was a multi-step problem (8 instances).

In the view of this researcher, it is weakness #3 that is instrumental in the drastic differential in performance between one-step and multi-step mathematical word problems demonstrated in the two B.C. Mathematics Assessments. Using such a problem-solving strategy, a student can find a key word, select the algorithm suggested by the key words, apply the algorithm, and get an answer. The answer, the algorithm, and the key words will all match, but the answer is only one part of the problem. Forty percent of the incorrect solutions to the multi-step problems were incorrect because the students treated the problems as one-step problems!

Searching for key words (clue words or phrases) is still an important method for determining any computational algorithms that may be needed to solve a word problem found in elementary school mathematics textbooks, but there is a caution. Once the key words are found the students should be encouraged to re-read the *entire* problem to put the key words into the context of the entire problem.

B. The students simply did not check their answers. Of the 108 problems used in the interviews, 11 were checked! Of the 11 problems checked, all were solved; so, of course, of the 22 problems worked incorrectly, none were checked. The data suggest strongly that students must be convinced of the importance of checking their work and the final solution.

C. Putting "Uses Algorithms" aside, the student made little use of the heuristics that have been observed in mathematical problem-solving research. One could jump to the conclusion that the teacher is at fault for students not experiencing the use of heuristics in their classes; however, it may be that those things called "story problems" in elementary school mathematics textbooks simply do not require the use of heuristics other than Uses Algorithms for solution.

D. Lastly, a positive note. The students were willing to persevere with any problem. Factors such as the problems being selected to be well within the ability level of the students, the arithmetic level being kept low, or even the pleasant manner of the interviewer may have been causes for the result, but the fact is every student worked on every problem. One student worked for almost half an hour on Problem I. That same student spent almost an hour on the six problems and missed only one.

Conclusions

Several disturbing findings were revealed in the interviews and subsequent protocol analysis. The students did not re-read the problems carefully, the students did not check their work or their answers, 40% of the multi-step problems that were missed were treated as one-step problems, and students used only one heuristic to any great extent.

More studies need to be done to try to discover if the root of some of the results is teacher-centred, textbook-centred, or student-centred. If the average teacher continues to be dependent upon the textbook as *the* source of problems and the textbooks fail to give students experience with multi-step problems and a variety of heuristics, then the next move is very different than if the source of the difficulty is teacher-centred or student-centred.

LIST OF PROBLEMS

A: A contractor is paid $18 000 in 12 equal payments (one each month). How much is the contractor paid each month?

B: A contractor is paid $18 000 in 12 equal payments (one each month). How much will the contractor have been paid in 5 months?

C: In one year a contractor is paid $18 000 in equal monthly payments. How much will the contractor have been paid in 5 months?

D: A grade 7 class practised a school play for 75 minutes a day for 7 days. How many minutes did they practise the play?

E: A grade 7 class practised a school play for 75 minutes a day for 7 days plus one final rehearsal of 90 minutes. How many minutes did they practise the play?

F: A grade 7 class practised a school play from 3:30 p.m. to 4:45 p.m. each day for 7 days plus one final rehearsal of 90 minutes. How many minutes did they practise the play?

G: In a discussion concerning summer activities a grade 7 class discovered that 14 of the students had spent their summer holidays in a Canadian province other than B.C., 8 had spent their holidays in the U.S., and 10 had spent their holidays in B.C.. How many spent their holidays in Canada?

H: In a discussion concerning summer activities a grade 7 class discovered that 14 of the students had spent their summer holidays in a Canadian province other than B.C., 8 had spent their holidays in the U.S., and 10 had spent their holidays in B.C.. How many more spent their holidays in Canada than the U.S.?

I: In a discussion concerning summer activities a grade 7 class discovered that 14 of the students had spent their summer holidays in a Canadian province other than B.C., 8 had spent their holidays in the U.S., and 10 had spent their holidays in B.C.. What fraction of the students spent their holidays in B.C.?

References

Blake, R.N. *The effect of problem context upon the problem solving process used by field dependent and independent students: A clinical study.* Unpublished doctoral dissertation, University of British Columbia, 1976.

Branca, N.A. Problem solving as a goal, process, and basic skill. In S. Krulik & R.E. Reys (Eds.), *Problem solving in school mathematics.* Reston, Virginia: The National Council of Teachers of Mathematics, 1980, 3-8.

Goals for School Mathematics. Boston: Houghton Mifflin Company, 1963.

Henderson, K.B., & Pingry, R.E. Problem-solving in mathematics. In H.F. Fehr (Ed.), *The learning of mathematics its theory and practice.* Washington, D.C.: The National Council of Teachers of Mathematics, 1953, 228-270.

Kantowski, E.L. *Processes involved in mathematical problem solving.* Unpublished doctoral dissertation, University of Georgia, 1974.

Kilpatrick, J. *Analyzing the solution of word problems in mathematics: An exploratory study.* Unpublished doctoral dissertation, Stanford University, 1967.

Kilpatrick, J. Problem solving in mathematics. Washington, D.C.: American Educational Research Association, *Review of Educational Research*, 1969, *39*(4), 523-534.

Krutetskii, V.A. *The psychology of mathematical abilities in school children.* (Edited by J. Kilpatrick & I. Wirszup.) Translated by J. Teller, National Science Foundation: Survey of Recent Eastern European Mathematical Literature, 1969.

Menchinskaya, N.A. Fifty years of Soviet instructional psychology. In J. Kilpatrick & I. Wirszup (Eds.), *Soviet studies in the psychology of learning and teaching mathematics.* National Science Foundation: School Mathematics Study Group and Survey of Recent Eastern European Mathematical Literature, 1969.

National Council of Teachers of Mathematics. *An Agenda for Action*, Reston Virginia: The National Council of Teachers of Mathematics, 1980.

Robitaille, D.F. (Ed.) *British Columbia Mathematics Assessment 1981: General report.* Victoria, B.C.: Ministry of Education, 1981.

Robitaille, D., & Sherrill, J. *B.C. Mathematics Assessment Report 1: Test results.* Victoria, B.C. Ministry of Education, 1977. (a)

Robitaille, D., & Sherrill, J. *B.C. Mathematics Assessment Report 2: Instructional practices.* Victoria, B.C.: Ministry of Education, 1977. (b)

Sherrill, J.M. *Solving multi-step mathematical word problems.* Report 80:18, Vancouver, B.C.: Educational Research Institute of British Columbia, 1980.

BOOK REVIEWS

INSTRUCTIONAL DESIGN FOR SPECIAL EDUCATION. *By David Baine.* Englewood Cliffs, NJ: Educational Technology Publications, 1982, 319 pp.

Professor Baine, of the University of Alberta, has written a practical book on instructional design and one which should prove useful both to practitioners in the field and those of us working in university and inservice settings. The book details the procedures for development of specific lessons and total units for handicapped learners. Drawing heavily on the research and programming style of Becker and Engleman's direct instruction, the material is clearest and best supported when dealing with basic skills and simple concepts. Readers looking for techniques for discovery learning, methods of affective education, or for academic discussions about the merits of one approach over another will be disappointed. Those looking for a concise source of detailed principles and procedures for the development of curriculum for severely impaired learners will find this an invaluable resource.

Each chapter is well organized with sufficient advance organizers, headings and subheadings, practice exercises, and vocabulary review to allow a student to work his or her way through with some degree of understanding and skill development, rather than merely reading it.

The text begins with a clear and extensive treatment of behavioral objectives and their development in specific education applications. The author includes the most detailed checklist I have seen for the writing and evaluating of behavioral objectives. His eight-stage model begins with a learner evaluation, prioritizing of goals, and a literature search of what is available. Following this, an analysis of the performance requirements of the objective is done, along with an analysis of any necessary learning "prosthetics." Only then does the author refer to the usual three elements of an objective: the performance, the conditions, and the standards.

Moving on to the difficult area of task analysis, Baine provides several examples and demonstrates several ways of organizing this process, along with another detailed checklist. Here he shows his debt to systems design principles in showing networking and in constructing a lattice of learning tasks. His hierarchic learning analysis is based primarily on Gagné and is well presented. A skill at developing a task analysis, while deceptively simple in concept, seems difficult to teach and I look forward to seeing how my students do with Dr. Baine's detailed and clear presentation.

In the next three chapters of the book, he explores and explains a great many applied learning principles in a fairly compact fashion. Relevant research is included and the chapters are clearly theoretically grounded but the emphasis remains on actually designing instructional sequences for real application. The approach is analytic, building learning from the bottom up, and providing as sophisticated a framework of supports as is needed for that learner. Included is consideration of forward and backward chaining, pacing, proactive and retroactive inhibition, prompting, cue fading, branching and looping and related concepts. The various methods of assuring motivation, including use of verbal, token, or

immediate reinforcers are considered here, along with the effects and role of various rates of reinforcement. Teachers meeting the educational problems of the handicapped for the first time will find these chapters a rich source of alternative ways to support learning.

Chapter six provides a worked example of an instructional design used by the author, bus travel for trainable mentally retarded young adults, which demonstrates the application of many of the principles discussed. Educators used to the relative paucity of detail in the typical lesson plans and instructional units may react to the amount of detail here, but teachers of the retarded will be struck by the level of success reported with this group.

Concept development is explored in further detail in the next two chapters, moving from discrimination learning of concrete concepts to sequences for concept formation. Again the strategies are specific, supported by research and detailed in their presentation. Dr. Baine makes explicit the difference between concrete concepts, which can be taught inductively, and defined or abstract concepts which depend on some external definition. He chooses to concentrate exclusively on the former. As a small point here, the use of behavioral jargon such as E and NE for examples and non-examples respectively, does not make the material easily accessible to the reader.

The final section covers formative and summative evaluation, with the emphasis on the former. In effect, this part loops the reader back to the beginning, since the development of goals and objectives is dependent, in part, on the procedures by which these will be evaluated, as the author points out. In fact, his checklist in this section is an excellent instrument for the evaluation of a unit of instructional material, whether designed by a local teacher, or produced by a commercial firm. Obviously, the critical issues in evaluation cannot be adequately dealt with in a scant 20 pages. Enough is presented, however, to give teachers or program designers some guidelines for looking at their work as they go along and when it is in use.

For all its depth in the areas covered, I would have liked to see more coverage of important additional topics. The issue of self-managed or self-monitored instructional programs was referred to in a paragraph. The continuous progress recording techniques developed by Ogden Lindsey and others, for instance, are unmentioned in this book. It is not fair, perhaps, to view a book in terms of what is not in it, but additional breadth would have strengthened it.

I was impressed enough that I have ordered it as a basic text for my graduate course in special education curriculum. Within the range of its stated purpose, this volume is excellent. No other single source is as clear, detailed and comprehensive, and supportive of student learning. The author has done a superb job of integration and organization and has created an almost tutorial text.

Robert B. MacIntyre
Department of Special Education
The Ontario Institute for Studies in Education.

THE SCHOOLS OF ONTARIO, 1876-1976. *By Robert M. Stamp.* Toronto: University of Toronto Press, 1982, 293 pp. (ISBN 0-8020-2437-8).

Beginning with Ontario's much-vaunted educational exhibit at the Philadelphia Exposition in 1876 to the centennial of the province's Ministry of Education in 1976, Robert M. Stamp, Co-ordinator of Canadian Studies Programs at the University of Calgary, provides a comprehensive review of the post-Ryersonian era of schooling in Ontario. To those who might ask why someone in the West was commissioned by the Ontario Historical Studies Board to undertake such a task, Stamp gives part of the answer in the preface. In questioning the "twin myths of centralization and superiority" found in much of Ontario's educational history, Stamp indicates that his analysis has been influenced by several perspectives. His parents, his wife, and Stamp himself were schooled in Ontario; only his children "were prevented from attending the schools of Ontario by the 1970s because of [his] decision to gain a spatial perspective on [his] native province by moving two thousand miles away." When his detachment and domestic bona fides are combined with another prefatory statement concerning his sympathy for periods of educational innovation, the reader is given a sense of what is to follow.

All of this suggests that Stamp would undoubtedly be comfortable with N. Sutherland's description of him as a "moderate revisionist." And while Stamp avoids the unswerving optimism of traditional historians of schooling in Ontario, such as C.E. Phillips or R.S. Harris, one doesn't have to go far into the work to find that he holds not a few Whiggish tendencies. For example, his chapter on "The Nooks and Crannies of Dr. Ryerson's Den," especially his comments on religion, language, and patriotism suggest that the principal difference between most traditional and moderate revisionist historians of Ontario education is methodological rather than ideological. To conclude, as Stamp does, that Catholic separate schools, whether anglophone or francophone, did not have the strengths or promise of the public school system, or that veneration for imperial institutions was a prelude to Canadian nationalism is to reflect the same onward and upward view of public schooling held by Phillips and others in the 1950s. Although Stamp's analysis manifests the sureness and competence of a social historian, he remains a public school promoter nonetheless. In 1977 J.D. Wilson in his landmark review, *Historiographical Perspectives on Canadian Educational History* wondered about the direction Stamp would take: "It will be interesting to observe to what extent Stamp is influenced by the radical school in his manuscript . . . on education in Ontario from 1876 to the present." While he is fully aware of the social control and related orientations of such radical revisionist historians as S. Prentice and T.R. Morrison, Stamp is neither negative in hindsight nor given to unmasking conspiracies.

Even if Stamp has been influenced by the radical critique, it is unlikely that it would have been helpful in his analysis of Catholic and francophone schools. Radicals are not given to attacking minority schools, the structure and outcomes of public schooling have been their principal targets. Traditional educational historians invariably viewed Catholic and francophone schools as reactionary holdouts and the Catholic hierarchy as villains for attempting to sustain them. Stamp's discussion of these institutions is fair, his research is reasonably thorough in terms of the themes discussed, but he offers nothing new or profound. One wonders, for example, about the economic and psychic costs experienced by generations of Catholic children because of separate school underfunding. Instead Stamp presents accounts of negotiations between the hierarchy and successive

government ministries, but even at the end of the work it is not clear whether separate schools have access to the same level of support as their public counterparts. One could well conclude that such a condition will only be achieved if Catholic schools follow the lead that francophone high schools took in 1968 when Premier John Robarts announced that these institutions would become part of the public rather than the separate school system. Robarts declared: "We do not intend to segregate the Franco-Ontarians from the mainstream of this province. Nor do they want to be segregated." As Catholic schools continue, it would seem, to be apart from mainstream Ontario, does one conclude that separate school supporters will continue to pay through a truncated and underfunded system for their obdurateness? Stamp's discussion seldom leaves the level of the titans involved; the pawns in the struggle receive scarcely a note.

One is also uneasy about Stamp's discussion of Ontario's new found tolerance of linguistic diversity. Federal bilingual initiatives and the reverberations of Quebec separatism deserve more attention, unless one assumes that the province's coming full circle from the restrictions of French language instruction of Regulation 17 in 1912 is yet another reflection of the innate superiority of Ontario's educational development. It will be recalled that this premise was one of the myths Stamp set out to question. An analysis of the realpolitik of this move together with the tentative steps towards multiculturalism might have led to a lively discussion of how the metropolis makes whatever accommodation is necessary in order to maintain hegemony. Stamp avoids the opportunity here as elsewhere to speculate on idiosyncratic reasons or on the shrewdness of political life that might have promoted such adjustments.

Stamp's discussion of the effects that industrialization had upon schooling is particularly valuable. Movements toward practical and vocational education in the late nineteenth and early twentieth century are well documented. But these discussions together with later efforts in technical and scientific education, prompted in part by advocates of human capital theory, sustain rather than dispel the myth of centralization. What is apparent is nearly all these initiatives were dependent on funding from the Ministry of Education. As the OECD's *Review of National Policies for Education (Canada, 1976)* indicates, "the reality of the educational governance developments of the past 10-15 years show a decisive move away from local school autonomy at least in matters of finance," and there is little in Stamp's analysis to contradict this assessment.

The discussion on the British connection favoured in the schools for much of the period is particularly telling. Anglo-Saxon racial superiority was a prevailing theme, and Stamp chronicles its hold on the minds of successive ministers of education. Modifications in this point of view began to appear in the late 1930s "with the internationalism of the League of Nations and the continental pull of the United States." But the old ties continued to be powerful, as the Conservatives found in 1943 when their references to the Empire helped them win a provincial election. These sentiments, however, began to wane after World War II, as did perennial attempts to find a form of religious instruction for public schools.

The old order seems to have been on its way out by the late 1960s. The publication of *Living and Learning* which Stamp describes as "the most radical and bold document to originate from the bureaucratic labyrinth of the provincial department of education" implied that Ontario might finally abandon Ryersonianism and move in new directions. Stamp is at his best here having carefully traced the steps leading to the "Liberalization of the Big Blue Schoolhouse" in earlier chapters on the New Education Movement at the start of the century and the progressive reforms of the late 1930s. But, of course, *Living*

and Learning with its emphasis on child-centredness had its critics, and its far-reaching recommendations evoked fears that their implementation would lead to chaos or that they were nothing more than a clever establishment ruse. So they became grist for the mills of radicals and traditionalists alike. Stamp lashes out at no one for slowing down or turning back many of the most promising reforms that surfaced during periods of educational innovation. His examination of the reasons for such recalcitrance is plausible. The open life style of the free schoolers, for example, was "too radical and inappropriate a model for Ontario or North American society to adopt en masse." Local control movements didn't take root in Ontario because students and parents were "more reluctant to seize power than were administrators to share it." Changes in educational policy continued to reflect Ryerson's successful formula: "proceed only as quickly as the conservative nature of provincial society will permit." Although he does not say so explicitly, Stamp's intimations are sufficient to lead the reader to conclude that Ontario has not changed its political or cultural boundaries over the last hundred years. In like manner he dispels the myth of Ontario's educational superiority by demonstrating that the Province has not changed its schooling strategies or redistributed power in any significant way since Ryerson's time. Whether he wishes the reader to arrive at such conclusions, however, is not clear, especially when the reader is left with a final statement about the "dynamic interaction" between "conservative and progressive paradigms" shaping the "values of Ontario's educational experience."

The book includes an interesting collection of pictures and an excellent set of notes, but is lacking in quantitative data concerning the origins and destination of pupils. At least one general map of Ontario and another of the more populated, southern region would have been helpful. A summary of the social, religious and educational backgrounds of the Premiers, Ministers of Education (who were often one and the same) and senior educational bureaucrats would have undoubtedly prompted some trenchant observations if not a fuller attempt in psychobiography. One must be thankful, nonetheless, for what Stamp has done. In an area of scholarship much given to publications of loosely connected series of articles introduced by an editorial overview, Stamp has written a good general history of schooling, and all those interested in the social history of Ontario should be well served by it.

Robert J. Carney
Department of Educational Foundations
The University of Alberta.

SPECIAL ISSUE-AUGUST 1983

THE JOURNAL OF EDUCATIONAL THOUGHT

WOMEN'S STUDIES AND HIGHER EDUCATION

This issue includes essays from Canada, the U.S.A., Australia, New Zealand and Britain; an annotated bibliography, and a book review section. It examines the various problems and approaches related to women's studies programs in five English-speaking countries. It raises questions related to women in higher education. This *unique* issue brings together contributions from Yale, Leeds, Kansas State, Simon Fraser, Waikato and Australian National Universities. *An invaluable reference tool!*

Single Issue: **$7.00 (U.S.)**
Bulk Order: **$6.00 (U.S.)**
(orders over twenty copies)

EDITOR: **PATRICIA T. ROOKE**

Cheques and Money Orders payable to:

THE JOURNAL OF EDUCATIONAL THOUGHT

Room 502 Education Tower, The University of Calgary
2500 University Drive N.W., Calgary, Alberta Canada
T2N 1N4

PREPARATION OF MANUSCRIPTS

1. All manuscripts must be typewritten, double spaced, and submitted in duplicate. An abstract of approximately 100 words in length, typed on a separate page, should be provided.
2. Tables must be numbered in Arabic numerals with the word 'Table' centered and in capital letters, e.g., TABLE 4. The heading of the table is to be centered below and typed in capitals. The format of tables should conform to the specifications in the APA Publications Manual.
3. Graphs and charts should be used only if essential. They must be carefully prepared on separate sheets in India ink, ready for reproduction. Graphs must be properly labelled using Arabic numerals, e.g., Figure 3.
4. Each table or figure should be presented on a separate page. The position of tables and graphs should be clearly indicated within the text by inserting at the relevent point the phrase (Insert Table 2 here).
5. References should appear in parentheses following the reference citing the author's name (unless the name appears in the text), the year of publication, and page number if appropriate. For direct quotations, the reference should be cited and the page number given in brackets before the final punctuation of the quotation. The references should be listed alphabetically by authors' last names at the end of the manuscript under the heading, *References*.
6. Explanatory notes, numbered consecutively and identified in the text with a superscript, may be included under the heading of *Notes*. They should be double spaced and placed at the end of the manuscript immediately preceding the *References*. The citing of references and quotations in the *Notes* should conform to the procedures outlined in No. 5 above.
7. Spelling shall conform to the *Oxford English Dictionary* or to the *Dictionary of Canadian English,* except in the case of direct quotations which must conform to the original. Editorial alterations will be made if necessary.
8. In matters of style, the APA Publications Manual is considered definitive.

PRINTED BY
THE UNIVERSITY OF ALBERTA
PRINTING DEPARTMENT